Essential Elements
Mathematics

For Students with
Significant Cognitive Disabilities
"Unpacked"

October 20, 2015

The Iowa Core Essential Elements (EEs) are specific statements of knowledge and skills linked to the grade-level expectations identified in the Iowa Core Standards. The purpose of the EEs is to build a bridge from the content in the Iowa Core Standards to academic expectations for students with the most significant cognitive disabilities. A group of general educators, special educators, and content specialists from member states in the Dynamic Learning Maps (DLM) Consortium gathered to determine the essence of the Common Core State Standards (CCSS). The stakeholder group members were selected by their states to participate in this work. State education agency (SEA) representatives and SEA-selected teachers collaborated to develop the EEs.

Instruction of the Iowa Core Math Essential Elements requires that

- Learning occurs through active participation and interaction with and exposure to meaningful content
- Learning that builds over time
- Application of knowledge and skills
- Active participation and interaction in learning activities
- Collaboration and communication (with adults and peers)
- Ongoing comprehensive instruction

The unpacked standards document identifies the concepts, skills, big ideas, and essential questions for each grade level cluster. This will help teachers understand what the student needs to know and be able to do. It is important to note that the standards do not support isolated skill development but conceptual understanding and skill development within context.

As individuals read through the unpacking it is also important to understand that the concepts, skills, and big ideas are written with vocabulary appropriate for the teacher. There is no expectation that students would repeat the wording in these sections. The essential questions were written from a student perspective. The essential questions should help teachers think about skills, concepts, and expressive communication opportunities.

Throughout the standards and the unpacked documents, communication implies a broad set of behaviors and combinations of behaviors which may or may not be a standardized form but which convey intent (purpose for communicating) and are understood by the listener. Since academic content is symbolic in nature, we must work to help students find ways to communicate what they know. We know this can be challenging for many students. Working closely with related services professionals and the students' parents is key. (qtd. in Unpacking the Extended Standards, DPI NC)

The unpacked Iowa Core Math Essential Elements provides teachers the concepts, skills, big ideas, and essential questions:

- To set the expectation for the learning goals in an instructional unit
- As instructional filters for selecting lessons and activities

Unpacking means to identify the concepts and skills found in the cluster of grade level EEs.

- What does the student need to know (concepts and content)?
- What does the student need to be able to do (skills)?
- Is there a context in which the information is nested (counting, equal shares, addition all nested in multiplication)?
- To what depth of understanding should the information be learned (identifying, remembering, analyzing, creating, etc.)

For every cluster the unpacked EEs document provides four components:

- Concept
    - Because the EEs were unpacked by cluster and not each Essential Element the concept is inferred from all of the EEs in the cluster

- Skills
    - What might that look like for students with significant cognitive disabilities?
        - Point
        - Eye gaze
        - Vocalize
        - Use of AAC system (with or without switches, high tech or low tech)
        - Partner assisted scanning
- Big Idea
    - What we want students to <u>comprehend</u> independently and <u>remember</u> indefinitely
        - Will the big idea apply to more than one content area of learning?
        - Will the big idea apply to more than one grade?
        - Will the big idea be important in the future?
        - Will the big idea be one a student can remember after instruction ends?

- Essential Questions
    - Are more narrowly focused and point to the big ideas and concepts
    - Provoke thought, discussion, inquiry, new understandings, and more questions

- Ask students to consider alternates, weigh evidence, support ideas, and justify answers
- Spark meaningful connections with prior learning, personal experience, and prior lessons
- Help students transfer knowledge to other situations and subjects

Teams of Iowa mathematics content and special education educators worked together to unpack the Iowa Core Mathematics Essential Elements

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These teams worked in consultation with Claire Greer, Ph.D. and Karen Erickson, Ph.D., Center for Literacy and Disabilities Studies, UNC, Chapel Hill who offered guidance based on their experience in standards and curriculum and alternate assessments of students with significant cognitive disabilities. As part of the unpacking process, the Dynamic Learning Maps in Mathematics were reviewed to ensure alignment to the concepts and skills assessed within the DLM Mathematics Alternate Assessment.

Why use the unpacked document? **E**ssentially, it is about ***good teaching*.**

- Teachers across the state have indicated unpacked standards will help them decide what is important for their students to learn, what concepts and skills students need to succeed, connect with high-level thinking skills, and engage students in the material by setting a purpose for learning.
- In short, it helps teachers create unit and lesson plans that connect within and across content areas.

Kindergarten Mathematics: Counting and Cardinality		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Know number names and the count sequence		
K.CC.1. Count to 100 by ones and by tens.	**EE.K.CC.1.** Starting with one, count to 10 by ones.	**Concept:** Numbers have meaning. **Skills:** Indicate the desire for more quantity of something; use number words when naming a quantity even if it is not the right number word; count 1-10 in sequence. **Big Idea:** Use words or numerals to represent quantity. **Essential Questions:** How do I communicate the number I want? What number names are used to count to 10? Which words describe how many?
K.CC.2. Count forward beginning from a given number within the known sequence (instead of having to begin at 1).	**Not applicable.** See EE.2.NBT.2.b.	
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).	**Not applicable.** See EE.2.NBT.3.	

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Kindergarten Mathematics: Counting and Cardinality		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Count to tell the number of objects		
K.CC.4. Understand the relationship between numbers and quantities; connect counting to cardinality.	**EE.K.CC.4.** Demonstrate one-to- one correspondence, pairing each object with one and only one number and each number with one and only one object.	**Concept:** Numbers have a sequence and represent quantity.
K.CC.4.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.4.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.4.c.** Understand that each successive number name refers to a quantity that is one larger.		**Skills:** Count objects using a one-to-one correspondence, pairing each object with one and only one number and each number with one and only one object; identify total quantity in a set using a single number name; count items (concrete, pictorial) to tell how many; count out up to three objects from a larger set. **Big Idea:** Use numbers to identify how many in a set. **Essential Questions:** What is the sequence I use to count? What number name goes with each object in the group? How do I know when to stop counting? How many objects are there? How can I organize the objects so I remember what I have counted?

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Kindergarten Mathematics: Counting and Cardinality		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Count to tell the number of objects		
K.CC.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.	**EE.K.CC.5.** Count out up to three objects from a larger set, pairing each object with one and only one number name to tell how many.	**Same as above.**
Compare numbers		
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.	**EE.K.CC.6.** Identify whether the number of objects in one group is more or less than (when the quantities are clearly different) or equal to the number of objects in another group.	**Concept:** Discriminates between groups. **Skills:** Identify a group of objects to be counted; identify two or more groups as more or less; identify two or more groups of equal value; identify two or more groups as more, less, or equal. **Big Ideas:** Sets can be compared by their relative quantities. **Essential Questions:** What is a group? Which group has more, less or equal quantities?
K.CC.7. Compare two numbers between 1 and 10 presented as written numerals.	**Not applicable.** See EE.2.NBT.4.	

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Kindergarten Mathematics: Operations and Algebraic Thinking		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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, drawings2, sounds (e.g., claps), acting out situations, verbal explanations, expressions, or equations.	**EE.K.OA.1.** Represent addition as "putting together" or subtraction as "taking from" in everyday activities.	**Concept:** Addition and subtraction are used to represent and solve many different kinds of problems. **Skills:** Identify a group as being more when two or more groups are put together; identify a group as being less when objects are taken away; use one-to-one correspondence to find the quantity of a group before and after "putting together" or "taking from" the group. **Big Idea:** The quantity of a group can change when items are put with or taken from a group. **Essential Questions:** What happens when I combine groups? What happens when I take groups apart?
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.	**Not applicable.** See EE.2.NBT.6–7.	
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).	**Not applicable.** See EE.1.NBT.6.	
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.	**Not applicable.** See EE.1.NBT.2.	
K.OA.5. Fluently add and subtract within 5.	**Not applicable.** See EE.3.OA.4.	

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Kindergarten Mathematics: Number and Operations in Base Ten		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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 (such as 18 = 10 + 8); understand that these numbers are composed of ten ones and one, two, three, four, five, six, seven, eight, or nine ones.	**Not applicable.** See EE.1.NBT.4 and EE.1.NBT.6.	**Not applicable.**

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Kindergarten Mathematics: Measurement and Data		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**EE.K.MD.1-3.** Classify objects according to attributes (big/small, heavy/light).	**Concept:** We find out about objects by looking at, touching, and directly comparing them. **Skills:** Identify objects as heavy or light; identify objects as small or big; identify objects as same or different; compare objects big/small, heavy/light; group objects by attributes. **Big Idea:** Objects with similar characteristics can be grouped together. **Essential Questions:** Are these objects the same or different? Are these objects big or small? Are these objects heavy or light?
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.		
Describe and compare measurable attributes		
K.MD.3. Classify objects into given categories; count the numbers of objects in each category and sort the categories by count.	**EE.K.MD.1-3.** Classify objects according to attributes (big/small, heavy/light).	**See Above**

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Kindergarten Mathematics: Geometry		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Identify and describe shapes (squares, circles, triangles, rectangles, hexagons, cubes, cones, cylinders, and spheres)		
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.	**Not applicable.** See EE.1.G.a.	**Concept:** Shapes have specific attributes. **Skills:** Recognize the name of a shape; identify shapes of the same size; identify shapes of the same orientation; group shapes based on attribute; match same shapes. **Big Idea:** Shapes can be categorized by similar characteristics. **Essential Questions:** Are these shapes the same or different? Do these shapes match?
K.G.2. Correctly name shapes regardless of their orientations or overall size.	**EE.K.G.2–3.** Match shapes of same size and orientation (circle, square, rectangle, triangle).	
K.G.3. Identify shapes as two-dimensional (lying in a plane, “flat”) or three-dimensional (“solid”).		

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Kindergarten Mathematics: Geometry		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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).	**Not applicable.** See EE.7.G.1.	**Not applicable.**
K.G.5. Model shapes in the world by building shapes from components (e.g., sticks and clay balls) and drawing shapes.	**Not applicable.**	
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?"	**Not applicable.** See EE.1.G.3.	

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First Grade Mathematics: Operations and Algebraic Thinking		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**EE.1.OA.1.a.** Represent addition and subtraction with objects, fingers, mental images, drawings, sounds (e.g., claps), or acting out situations.	**Concept:** The quantity of a set can change when items are added or subtracted. **Skills:** Represent addition and subtraction; count objects in sets to determine if they are equal in quantity; communicate "same quantity"; use put together to solve problems. **Big Idea:** There are flexible methods of representing addition and subtraction in order to solve problems. One-to-one correspondence can be used to compare sets. **Essential Questions:** How can I represent the problem? How many items will there be if items are added or subtracted? How do I know if two sets have the same quantity? What does putting together do to the set?
	EE.1.OA.1.b. Recognize two groups that have the same or equal quantity.	
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.	**EE.1.OA.2.** Use “putting together” to solve problems with two sets.	

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First Grade Mathematics: Operations and Algebraic Thinking		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Understand and apply properties of operations and the relationship between addition and subtraction		
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 10, so 2 + 6 + 4 = 2 + 10 = 12. (Associative property of addition.)	**Not applicable.** See EE.6.EE.3 and EE.N-CN.2.	**Not applicable.**
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.	**Not applicable.** See EE.1.NBT.4 and EE.1.NBT.6.	

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First Grade Mathematics: Operations and Algebraic Thinking		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
	Add and subtract within 20	
1.OA.5. Relate counting to addition and subtraction (e.g., by counting on 2 to add 2).	**EE.1.OA.5.a.** Use manipulatives or visual representations to indicate the number that results when adding one more.	**Concept:** The quantity of a set can change when items are added or subtracted.
	EE.1.OA.5.b. Apply knowledge of "one less" to subtract one from a number.	**Skills:** Use manipulatives and pictorial representations to add or subtract one; indicate the quantity when adding and subtracting one; use 1:1 correspondence.
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 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).	**Not applicable.** See EE.3.OA.4.	**Big Idea:** Adding to a set makes the quantity more and subtracting from a set makes the quantity less. **Essential Questions:** How do I represent a collection of objects when adding or subtracting one? What number represents the set when I add or subtract one? What happens to set when I add or subtract one?

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First Grade Mathematics: Operations and Algebraic Thinking		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**Not applicable.** See EE.1.OA.1.b and EE.2.NBT.5.a.	**Not applicable.**
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 = _.	**Not applicable.** See EE.3.OA.4.	

First Grade Mathematics: Numbers and Operations in Base Ten		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**EE.1.NBT.1.a.** Count by ones to 30. **EE.1.NBT.1.b.** Count as many as 10 objects and represent the quantity with the corresponding numeral.	**Concept:** Numbers have a sequence and represent quantity. **Skills:** Count objects using a one-to-one correspondence using correct sequence of number words; identify or represent total quantity using a single number word; identify or represent total quantity using a single numeral; count items (concrete, pictorial) to tell how many; recognize a counted set moved to another position doesn't change the value. (Conservation of number.) **Big Idea:** A numeral represents a quantity. Counting tells how many objects in a quantity. When counting, the last number counted is the total number of items; it is a cumulative count. **Essential Questions:** What number comes next? How many objects are there in the group? What was the last number I counted? How many do I have now (when a set is moved to a different position)?

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First Grade Mathematics: Numbers and Operations in Base Ten		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
	Understand place value	
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:	**EE.1.NBT.2.** Create sets of 10.	**Concept:** Sets of ten must be perceived as a single entity when interpreting numbers using place value (e.g., 1 ten is one group, it is 10 ones). **Skills:** Count objects to 10; separate objects into groups of 10; identify 10 as a composition of ten ones; compare groups of objects. **Big Idea:** Objects that are grouped are a set; objects can be grouped by a given number. Benchmark numbers such as 5 and 10 can be used to compare sets. **Essential Questions:** How many items do I want to put in each group? How do I keep track of the number of items I put in a group? Are the groups more, less or the same? How do I know when I have 10? What do I do with my extras? How many (more or less) do I need to make a set of 5 or 10?
1.NBT.2.a. 10 can be thought of as a bundle of ten ones—called a "ten."		
1.NBT.2.b. The numbers from 11 to 19 are composed of a ten and one, two, three, four, five, six, seven, eight, or nine ones.		
1.NBT.2.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 <.	**EE.1.NBT.3.** Compare two groups of 10 or fewer items when the number of items in each group is similar.	

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First Grade Mathematics: Numbers and Operations in Base Ten		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Use place value understanding and properties of operations to add and subtract		
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.	**EE.1.NBT.4.** Compose numbers less than or equal to five in more than one way.	**Concept:** Any number can be represented in a number of ways that have the same value. **Skills:** Identify the smaller numbers that make up a larger number (part-part-whole); use smaller quantities to compose larger quantities; break apart a larger quantity into at least two groups of smaller quantities; put the two groups back together to produce the original quantity; describe quantities in comparison to the benchmark of 5. **Big Idea:** Numbers can be composed and decomposed. The same quantity can be created in many ways.
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.	**Not applicable.** See EE.1.OA.5.a and EE.1.OA.5.b.	

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First Grade Mathematics: Numbers and Operations in Base Ten		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Use place value understanding and properties of operations to add and subtract		
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.	**EE.1.NBT.6.** Decompose numbers less than or equal to five in more than one way.	**Essential Questions:** How can I represent the same quantity in different ways? What is the number name for that quantity? How does this quantity compare to the quantity of 5? What words can I use to describe the quantity?

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First Grade Mathematics: Measurement and Data		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**EE.1.MD.1–2.** Compare lengths to identify which is longer/shorter, taller/shorter.	**Concept:** Length is an attribute that can be compared. **Skills:** Use direct comparison to determine the lengths of objects that are longer/shorter, taller/shorter; compare objects to determine which has more or less length. **Big Idea:** Objects can be different lengths. Words can be used to describe and compare the length of objects. **Essential Questions:** Which object has more or less length? What words describe an object with less length or more length?
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.		

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First Grade Mathematics: Measurement and Data		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
	Tell and write time	
1.MD.3. Tell and write time in hours and half-hours using analog and digital clocks.	**EE.1.MD.3.a.** Demonstrate an understanding of the terms tomorrow, yesterday, and today.	**Concept:** Events occur at different times. **Skills:** Identify events that occur today, tomorrow, or yesterday; identify events that occur in the morning and the afternoon, day and night; identify activities that come before, next, and after; anticipate a familiar activity based on the daily schedule; recognize that some events happen every day; represent time with words. **Big Idea:** Use words to describe when an event takes place. **Essential Questions:** What words can I use to describe when an event happens or is going to happen? How do I know what is going to happen at different times of the day? What are things that happen at similar times every day? What happens after lunch? What do I do in the morning? Based on my schedule or routine, what do I think will happen next?
	EE.1.MD.3.b. Demonstrate an understanding of the terms morning, afternoon, day, and night.	
	EE.1.MD.3.c. Identify activities that come before, next, and after.	
	EE.1.MD.3.d. Demonstrate an understanding that telling time is the same every day.	

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First Grade Mathematics: Measurement and Data		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
	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.	**EE.1.MD.4.** Organize data into categories by sorting.	**Concept:** Use data to answer questions. **Skills:** Identify the question the data refers to; identify the data; categorize or group information by similarity; organize data by categories from most to least or least to most. **Big Idea:** Data can be arranged in categories. **Essential Questions:** What is the question? What do the numbers (data) represent? How can items or visual representations of items be organized? How does data help me answer questions?

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First Grade Mathematics: Geometry		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
	Reason with shapes and their attributes	
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.	**EE.1.G.1.** Identify the relative position of objects that are on, off, in, and out.	**Concept:** Shapes and objects can be oriented in many ways, and its location can be described. **Skills:** Use the words on, off, in, and out to describe the position of an object; find an object when given its relative position to another familiar object; name the shapes; sort shapes of same size and orientation; put parts together to make a whole. **Big Idea:** Words can describe where an object is located. Shapes have specific names and attributes. Shapes can be sorted by attributes. Shapes can be broken into parts and put back together to create the whole. **Essential Questions:** What word describes where an object is located? How do I know these shapes are the same? What parts make a whole? What shape is this?
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.	**EE.1.G.2.** Sort shapes of same size and orientation (circle, square, rectangle, triangle).	
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.	**EE.1.G.3.** Put together two pieces to make a shape that relates to the whole (i.e., two semicircles to make a circle, two squares to make a rectangle).	

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Second Grade Mathematics: Operations and Algebraic Thinking		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Represent and solve problems involving addition and subtraction		
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.	**Not applicable.** See EE.3.OA.4.	**Not applicable.**
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Add and subtract within 20		
2.OA.2. Fluently add and subtract within 20 using mental strategies. 6 By end of Grade 2, know from memory all sums of two one-digit numbers.	**Not applicable.** See EE.2.NBT.6–7 and EE.3.OA.4.	**Not applicable.**

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Second Grade Mathematics: Operations and Algebraic Thinking		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**EE.2.OA.3.** Equally distribute even numbers of objects between two groups.	**Concept:** Some quantities can be organized and represented in equal groups. **Skills:** Distribute objects equally between two sets; identify the quantities up to 10 that can be shared fairly or equally; identify these quantities as even numbers; identify quantities as not even (odd) numbers if there are left overs; add groups to find total number of objects. **Big Idea:** Groups that can be shared fairly or equally have an even number of objects. **Essential Questions:** What is the task asking me to do? What information do I have? How can I use the objects to help me? Can I pair up all the objects in this group? How are even and odd numbers different? How many will there be when these groups are joined together?
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.	**EE.2.OA.4.** Use addition to find the total number of objects arranged within equal groups up to a total of 10.	

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Second Grade Mathematics: Numbers and Operations in Base Ten		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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:	**EE.2.NBT.1.** Represent numbers up to 30 with sets of tens and ones using objects in columns or arrays.	**Concept:** The value of a digit depends on its place, or position, in the number. **Skills:** Use place value tools (i.e., ten- frame, hundreds chart, base ten blocks, etc.) to combine groups of 10 and 1's to represent quantities; count from 1-30 using concrete, pictorial, and symbolic/numeral representations; name the number word applied to the last object representing the total amount; count forward beginning from a given number; name the next number in a sequence (e.g., 3, 4,____, 6, 7. or 2, 4, ___, 8. or 7, 6, 5, ___.); identify numerals 1 to 30; compare sets using the words more, less, and equal. **Big Idea:** Numbers beyond nine are composed of groups of tens and ones. Sequence is a series of numbers that follows a logical rule or pattern.
2.NBT.1.a. 100 can be thought of as a bundle of ten tens—called a “hundred.”		
2.NBT.1.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).		

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Second Grade Mathematics: Numbers and Operations in Base Ten		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Understand place value		
2.NBT.2. Count within 1000; skip-count by 5s, 10s, and 100s.	**EE.2.NBT.2.a.** Count from 1 to 30 (count with meaning; cardinality).	**Essential Questions:** How can I represent this number using groups of tens and ones? How many groups of ten and how many ones are in this quantity? What numeral represents the quantity? What number is next? How can I keep track of what I have or have not counted? What number comes next in this sequence? Which group has more or less objects? Which groups have the same amount of objects?
	EE.2.NBT.2.b. Name the next number in a sequence between 1 and 10.	
2.NBT.3. Read and write numbers to 1000 using base-ten numerals, number names, and expanded form.	**EE.2.NBT.3.** Identify numerals 1 to 30.	
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.	**EE.2.NBT.4.** Compare sets of objects and numbers using appropriate vocabulary (more, less, equal).	

Second Grade Mathematics: Numbers and Operations in Base Ten		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**EE.2.NBT.5.a.** Identify the meaning of the "+" sign (i.e., combine, plus, add), "–" sign (i.e., separate, subtract, take), and the "=" sign (equal). **EE.2.NBT.5.b.** Using concrete examples, compose and decompose numbers up to 10 in more than one way.	**Concept:** Relationships between numbers or values can be represented with symbols. **Skills:** Use concrete, pictorial, and numeral representations to show what +, - , = mean; combine sets; break number up into smaller subsets; describe '+' action as "add", "plus", "combine," or "and"; describe '-' action as "separate," "subtract," or "take"; describe '=' as "equal" or "the same amount"; combine smaller groups to determine total number from 0-20; show part-part-whole; take away from total number to determine parts of number; compose and decompose numbers (e.g., 7 = 3 + 4, 7 = 5 + 2, 7 - 5 = 2 with concrete manipulatives); use concrete, pictorial, and numeral representations to add and subtract.

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Second Grade Mathematics: Numbers and Operations in Base Ten		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Use place value understanding and properties of operations to add and subtract		
2.NBT.6. Add up to four two-digit numbers using strategies based on place value and properties of operations.	**EE.2.NBT.6-7.** Use objects, representations, and numbers (0–20) to add and subtract.	**Big Idea:** Numbers can be taken apart to create smaller groups or put together to create larger groups. **Essential Questions:** What do I do with these sets when there is a '+'? How many will I have when I combine these sets? What do I do with these sets when there is a '-'? How many will be in each set when I separate the whole into parts? How else can I separate the whole into parts? How many will I have when I put the parts back together? What symbol can I use to show two sets have the same amount? How can I make these two sets equal? What words can I use to describe what I did? Is there another way I can represent the problem? How?
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.8. Mentally add 10 or 100 to a given number 100–900, and mentally subtract 10 or 100 from a given number 100–900.	**Not applicable.**	
2.NBT.9. Explain why addition and subtraction strategies work, using place value and the properties of operations.	**Not applicable.**	

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Second Grade Mathematics: Measurement and Data		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Measure and estimate lengths in standard units		
2.MD.1. Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.	**EE.2.MD.1.** Measure the length of objects using non-standard units.	**Concept:** Objects can be measured and ordered in many ways. **Skills:** Recognize attribute of length; use non-standard tools to measure objects, (e.g. paper clips, color tiles); use equal sized units to measure two or more objects; lay non-standard unit end-to-end to measure; count the total units to determine length; use non-standard unit measure to order objects by length; compare size of unit to how many are needed to measure the same object. **Big Idea:** Lengths can be compared using ideas such as longer, shorter, and equal. The longer the unit of measure, the fewer units it takes to measure the object. **Essential Questions:** how many units (i.e., paper clips, popsicle sticks, erasers) is this object? Which object is longer? Which object is shorter? What other tool can I use to measure the object? Which object should I use to measure this? What will happen to the amount of objects if I use a smaller or larger object of measure?
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.	**Not applicable.**	
2.MD.3. Estimate lengths using units of inches, feet, centimeters, and meters.	**EE.2.MD.3–4.** Order by length using non-standard units.	
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.		

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Second Grade Mathematics: Measurement and Data		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**EE.2.MD.5.** Increase or decrease length by adding or subtracting unit(s).	**Concept:** Lengths can get bigger or smaller when units are added or subtracted. **Skills:** Use addition of a unit to make something longer; use subtraction of a unit to make something shorter; use number line as a tool for measuring length; add one more unit on number line to make something longer. **Big Idea:** A number line has evenly spaced points corresponding to the numbers and can be used as a measurement tool. **Essential Questions:** How long is this? What will happen if I add one more? What will happen if I take one unit away? How can I make the length longer? How can I make a length shorter? When measuring with a number line, what direction should I move to if I am adding one more unit?
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.	**EE.2.MD.6.** Use a number line to add one more unit of length.	

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Second Grade Mathematics: Measurement and Data		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**EE.2.MD.7.** Identify on a digital clock the hour that matches a routine activity.	**Concept:** Time and money are types of measurement. **Skills:** Identify the tools that help measure how time passes; identify the hour on a digital clock; use a digital clock to identify familiar events that occur at a defined time each day; identify or name objects as money or not money; exchange money for an item. **Big Idea:** Events occur at different times and can be identified on a clock. Money is used to buy things. **Essential Questions:** How do I know when an activity will occur? What time do I have this activity? When I buy something, what do I give them?
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?	**EE.2.MD.8**. Recognize that money has value.	

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Second Grade Mathematics: Measurement and Data		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**EE.2.MD.9-10.** Create picture graphs from collected measurement data.	**Concept:** Data can be represented visually using tables, charts, and graphs. **Skills:** Identify parts of picture graph; organize data to answer a question; represent data using pictures or symbols. **Big Idea:** Picture graphs are useful for comparing data in different categories and answering questions. **Essential Questions:** What are the parts of a picture graph? What question does my graph help me answer? What categories can I use to organize the data? What picture or symbol will I use to represent the data? What is a good title for my graph? How can I label the graph so others will understand it?
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.		

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Second Grade Mathematics: Geometry		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Reason with shapes and their attributes		
2.G.1. Recognize and draw shapes having specified attributes, such as a given number of angles or a given number of equal faces.8 Identify triangles, quadrilaterals, pentagons, hexagons, and cubes.	**EE.2.G.1.** Identify common two-dimensional shapes: square, circle, triangle, and rectangle.	**Concept:** Shapes can be described, classified, and analyzed by their attributes. **Skills:** Identify a square, circle, triangle, and rectangle; name a square, circle, triangle, and rectangle; identify shapes in the environment. **Big Idea:** Shapes have specific names and characteristics. **Essential Questions:** How do I know what shape this is? What is the name of this shape? Where else can I find this shape?
2.G.2. Partition a rectangle into rows and columns of same-size squares, and count to find the total number of them.	**Not applicable.**	
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.	**Not applicable.** See EE.4.G.3 and EE.4.NF.1–2.	

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Iowa CORE ESSENTIAL ELEMENTS

Third Grade Mathematics: Operations and Algebraic Thinking

Iowa Core Grade-Level Standards	Iowa Core Essential Element	Unpacked
Represent and solve problems involving multiplication and division		
3.OA.1. Interpret products of whole numbers, e.g., interpret 5 × 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.		**Concept:** Multiplication can be represented in different ways (e.g., repeated addition of equal groups, skip counting, objects in an array, area of a rectangle).
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.	**EE.3.OA.1-2.** Use repeated addition to find the total number of objects and determine the sum.	**Skills:** Counts equal groups by using repeated addition (e.g., 2+2+2+2 = 8); add and subtract numbers when result is unknown (e.g., 3 + 2 =)
		Big Idea: Addition and subtraction are used to represent and solve many different kinds of problems.
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.	**Not applicable.** See EE.3.OA.1 and EE.5.NBT.5.	

Third Grade Mathematics: Operations and Algebraic Thinking		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Represent and solve problems involving multiplication and division		
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 = ?	**EE.3.OA.4.** Solve addition and subtraction problems when result is unknown, limited to operands and results within 20.	**Essential Questions:** How do I use addition and subtraction to solve problems? How can I keep track of the groups I have or have not counted? How do addition and subtraction problems relate to each other? How do I know which mathematical operation (+, -) to use?
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Understand properties of multiplication and the relationship between multiplication and division		
3.OA.5. Apply properties of operations as strategies to multiply and divide.9 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.)	**Not applicable.** See EE.N-CN.2.	**Not applicable.**
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.	**Not applicable.** See EE.5.NBT.6–7.	

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Third Grade Mathematics: Operations and Algebraic Thinking		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Multiply and divide within 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 × 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.	**Not applicable.** See EE.7.NS.2.a and EE.7.NS.2.b.	**Not applicable.**

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Third Grade Mathematics: Operations and Algebraic Thinking		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**EE.3.OA.8.** Solve one-step real-world problems using addition or subtraction within 20.	**Concept:** Addition and subtraction are used to represent and solve many different kinds of problems. **Skills:** Identify what the question is asking; identify which operation will help solve the problem; develop an equation to solve the problem; solve for the unknown in an addition and subtraction equations. **Big Idea:** The context of a problem determines the operation that is used to solve the problem. **Essential Questions:** How do I know which mathematical operation (+, -) to use? How do I know where to begin when solving a problem? How do I use addition or subtraction to find the missing value? What do I do when I get stuck?

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Third Grade Mathematics: Operations and Algebraic Thinking		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Solve problems involving the four operations, and identify and explain patterns in arithmetic		
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.	**EE.3.OA.9.** Identify arithmetic patterns.	**Concept:** Patterns are important learning tools to help us see relationships and make connections between concepts. **Skills:** Recognize the core unit in repeating, symbolic, and growing patterns; skip count by 2's, 5's and 10's; identify common change; identify the rule used in the pattern; recognize if the change in the pattern is increasing, decreasing, or constant; extend the pattern; identify the next number in a pattern. **Big Idea:** Patterns can be recognized, analyzed, and extended. **Essential Questions:** What is the core pattern of this sequence? How do I know? What rule was used to make the pattern? What is the next number in this pattern? How can I extend the pattern? Is the change in the pattern increasing, decreasing, or staying the same?

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Third Grade Mathematics: Numbers and Operations in Base Ten		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**EE.3.NBT.1.** Use decade numbers (10, 20, 30) as benchmarks to demonstrate understanding of place value for numbers 0–30.	**Concept:** The base ten numeration system provides a structure for recording numbers using digits 0-9, groups of ten, and place value. **Skills:** Compare numbers using the decade benchmark to estimate if a number is greater than (>), less than (<) and equal to (=) another number; use models to demonstrate how many tens and ones are in a given numbers; use manipulatives to skip count by 10's. **Big Idea:** The value of a digit depends on its place, or position, in the number. **Essential Questions:** How does using 10 as a benchmark help me compare numbers? How can making equal groups of ten objects help me count larger numbers? How can I easily locate 10 more or 10 less on a hundreds chart? How do I model a number larger than 9? How does using 10 as a benchmark help me compose numbers?
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.	**EE.3.NBT.2.** Demonstrate understanding of place value to tens.	
3.NBT.3. Multiply one-digit whole numbers by multiples of 10 in the range 10–90 (e.g., 9 × 80, 5 × 60) using strategies based on place value and properties of operations.	**EE.3.NBT.3.** Count by tens using models such as objects, base ten blocks, or money.	

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Third Grade Mathematics: Number and Operations—Fractions		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Develop understanding of 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.	**EE.3.NF.1–3.** Differentiate a fractional part from a whole.	**Concept:** Fractions are numbers that can be represented in different ways. **Skills:** Recognize a whole; create equal- sized parts; use multiple representations; identify a unit fraction (one part when a whole is partitioned into n equal parts); model part/whole relationships. **Big Idea:** A fraction represents equal parts of a whole. **Essential Questions:** Which shape/object is a whole? Which shape/object is a part of the whole? What is a fraction? How do I divide this shape so it has equal sized parts? How many equal parts made up the whole? How can I represent one part (unit fraction) of a shape? What other shapes can I divide equally?
3.NF.2. Understand a fraction as a number on the number line; represent fractions on a number line diagram.		
3.NF.2.a. 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.		
3.NF.2.b. 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.		
3.NF.3. Explain equivalence of fractions in special cases, and compare fractions by reasoning about their size.		

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Third Grade Mathematics: Number and Operations—Fractions		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Develop understanding of fractions as numbers		
3.NF.3.a. Understand two fractions as equivalent (equal) if they are the same size, or the same point on a number line.		**Same as above.**
3.NF.3.b. 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.		
3.NF.3.c. 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.		
3.NF.3.d. 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.		

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Third Grade Mathematics: Measurement and Data		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Solve problems involving measurement and estimation of intervals of time, liquid volumes		
3.MD.1. Tell and write time to the nearest minute, and measure time intervals n minutes. Solve word problems involving addition and subtraction of time intervals in minutes, e.g., by representing the problem on a number line diagram.	**EE.3.MD.1.** Tell time to the hour on a digital clock.	**Concept:** Measurement involves an understanding of appropriate measurement units in various situations, how many units there are, the measurement processes, and of the use of measurement tools. **Skills:** Identify the hour on a digital clock; use a digital clock to identify events that occur at a defined time each day; identify volume as the space inside an object; identify mass as the weight of an object; choose measurement tools to solve problems; solve one-step word problem, identify operation, organize numbers, solve for unknown; identify unit for answer. **Big Idea:** Familiarity with known benchmark measurements and measurement tools can help when calculating other measurements. **Essential Questions:** How can I use a digital clock to tell time to the hour? What does mass measure? What does volume measure? What are the tools I can use to measure mass or volume? What is the problem asking us to solve? Which tool will I use to solve it? What unit do I use to label my answer?
3.MD.2. Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l).13 Add, subtract, 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.	**EE.3.MD.2.** Identify the appropriate measurement tool to solve one-step word problems involving mass and volume.	

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Third Grade Mathematics: Number and Operations—Fractions		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Represent and interpret data		
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.	**EE.3.MD.3.** Use picture or bar graph data to answer questions about data.	**Concept:** Information can be collected and displayed as objects in pictures, graphs and tables. Objects can be measured and ordered in different ways. **Skills:** Interprets data presented by a picture/bar graph (i.e., more, less, same, how many); use standard measuring tools; line objects up to the end of measuring tool; identify and read numbers on a standard measuring tool; state or record the length of objects. **Big Idea:** Data can be represented to answer questions. Standard units of measurement provide consistency in measurement. **Essential Questions:** What do I know from the data? What questions can I answer from my data? How do labels help others understand the data? How can I measure an object? What tools can I use to measure the length of this object? How long is this object? Should I use inches, feet, or meters?
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.	**EE.3.MD.4.** Measure length of objects using standard tools, such as rulers, yardsticks, and meter sticks.	

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Third Grade Mathematics: Number and Operations—Fractions		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Geometric measurement: understand concepts of area, and relate area to multiplication and to addition		
3.MD.5. Recognize area as an attribute of plane figures and understand concepts of area measurement.	**Not applicable.** See EE.4.MD.2.	**Not applicable.**
3.MD.5.a. A square with side length of 1 unit, called "a unit square," is said to have "one square unit" of area, and can be used to measure area.		
3.MD.5.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.6. Measure areas by counting unit squares (square cm, square m, square in., square ft, and improvised units).		
3.MD.7. Relate area to the operations of multiplication and addition.		
3.MD.7.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.7.b. 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.		

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Third Grade Mathematics: Number and Operations—Fractions		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Geometric measurement: understand concepts of area, and relate area to multiplication and to addition		
3.MD.7.c. 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 × b and a × c. Use area models to represent the distributive property in mathematical reasoning.	**Not applicable.**	**Not applicable.**
3.MD.7.d. Recognize area as additive. Find areas of rectilinear figures by decomposing them into non-overlapping rectangles and applying this technique to solve real world problems.		
Geometric measurement: recognize perimeter as an attribute of plane figures, and distinguish between linear and area measures		
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.	**Not applicable.** See EE.7.G.4 and EE.8.G.9.	**Not applicable.**

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Third Grade Mathematics: Geometry		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**EE.3.G.1.** Describe attributes of two-dimensional shapes.	**Concept:** Shapes can be described and classified according to their attributes. **Skills:** Identify a line and line segment; identify an angle; identify the number of sides (vertices); identify the number of angles; identify equal parts of a shape; divide shapes into equal pieces. **Big Idea:** Shapes can be defined by their attributes. Shapes can be partitioned into equal parts. **Essential Questions:** What makes shapes different from each other? What is the name of that shape? How do I divide (cut) this shape into equal parts? How many equal parts could I divide (cut) this shape into? How could I describe this shape using its attributes?
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.	EE.3.G.2. Recognize that shapes can be partitioned into equal areas.	

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Fourth Grade Mathematics: Operations and Algebraic Thinking		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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 × 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.	**EE.4.OA.1-2.** Demonstrate the connection between repeated addition and multiplication.	**Concept:** Real life situations or problems can be solved using different mathematical operations. **Skills:** Create equal sets; combine sets; use repeated addition with equal sets; use knowledge of repeated addition to solve multiplication problems; identify what the question is asking; identify which operation will help solve the problem; organize numbers to create an equation; solve for the unknown. **Big Idea:** Repeated addition can be used to explain multiplication. Solving problems that involve the same numbers help make the connection between addition and subtraction (e.g., 3 + 4 =7, 7 - 4 =3). **Essential Questions:** How can I use repeated addition to solve this multiplication problem? How do I set up a repeated addition problem? What is the problem asking? What operation can I use to solve the problem? How do I recognize what strategy to use for a specific problem?
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.		
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.	**EE.4.OA.3.** Solve one-step real-world problems using addition or subtraction within 100.	

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Fourth Grade Mathematics: Operations and Algebraic Thinking		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Gain familiarity with factors and multiples		
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.	**EE.4.OA.4.** Show one way to arrive at a product.	**Concept:** There are a variety of operations and strategies that can be applied to solve problems. **Skills:** Use array model to solve problem; use skip counting to solve problem; use repeated addition to solve problem. **Big Idea:** Multiplication can be represented in different ways. **Essential Questions:** How can I use the array model to find the solution? How can I relate what I know about skip counting to help me solve this problem? How can I relate what I know about repeated addition to help me solve this problem?

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Fourth Grade Mathematics: Operations and Algebraic Thinking		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**EE.4.OA.5.** Use repeating patterns to make predictions.	**Concept:** Patterns help us see relationships, make connections between concepts, and make predictions. **Skills:** Recognize the unit in a repeating pattern with pictures or symbols; extend the pattern; describe how the pattern changes; make a prediction about the repeated core unit; describe a general rule for determining any stage of the pattern. **Big Idea:** Patterns can be identified, predicted and repeated. **Essential Questions:** What is the core unit in the repeating pattern? How does the pattern grow? What changes as the pattern grows? What stays the same as the pattern grows? Based on the pattern rule, what do I think the next shape will be? What about the next shape after that?

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Fourth Grade Mathematics: Numbers and Operations in Base Ten		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Generalize place value understanding for multi-digit whole numbers		
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.	**Not applicable.** See EE.5.NBT.1.	**Concept:** The value of a digit depends on its place, or position in the number. **Skills:** Identify place value of numbers; compare numbers using < > =, identify the benchmarks on a number line; identify the midpoint on a number line (e.g., the midpoint between the benchmarks of 20 and 30 is 25); identify that numbers less than the midpoint on the number line round down, numbers the same as or greater than the midpoint round up; use the ones place to determine the nearest benchmark number in the tens place. **Big Idea:** Numbers can be compared. Rounding is a useful strategy when you don't have to have an exact number. **Essential Questions:** Is __more than, less than, or equal to____? What symbol do I use to show that a number is greater than, less than, or equal to another number? When I solve this problem, do I need an exact answer or an estimate? What are the benchmarks on either side of the number I want to round? What is the midpoint? Should I round up or down?
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.	**EE.4.NBT.2.** Compare whole numbers to 10 using symbols (<, >, =).	
4.NBT.3. Use place value understanding to round multi-digit whole numbers to any place.	**EE.4.NBT.3.** Round any whole number 0-30 to the nearest ten.	

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Fourth Grade Mathematics: Numbers and Operations in Base Ten		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**EE.4.NBT.4.** Add and subtract two-digit whole numbers.	**Concept:** Mathematical problems can be solved using different mathematical operations. **Skills:** Use concrete, pictorial, and symbol/numeral representations to add and subtract 2-digit numbers; identify place value of numbers; group ten's together and the ones together to add or subtract 2 digit numbers; create equation to add or subtract 2 digit numbers, find sum for addition problems and the difference for subtraction problems; use the identity, associative, and commutative properties to help solve equations. **Big Idea:** Numbers can be broken apart and grouped in different ways to make calculations simpler. Place value is important when solving problems with multi-digit numbers. **Essential Questions:** Will I need to add or subtract to solve the problem? How many tens/ones are in this 2-digit number? How can I use the tens and ones of the 2 digit numbers to add or subtract? How can I represent this problem? Which property of addition or subtraction might help me solve this problem?
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.	**Not applicable.** See EE.4.OA.1.	

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Fourth Grade Mathematics: Numbers and Operations in Base Ten		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Use place value understanding and properties of operations to perform multi-digit arithmetic		
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.	**Not applicable.**	**See above.**

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Fourth Grade Mathematics: Number and Operations—Fractions		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Generalize place value understanding for multi-digit whole numbers		
4.NF.1. Explain why a fraction a/b is equivalent to a fraction (n × a)/(n × 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.	**EE.4.NF.1–2.** Identify models of one half (1/2) and one fourth (1/4).	**Concept:** A fraction describes the division of a whole into equal parts. **Skills:** Identify the meaning of the numerator and denominator (i.e., the bottom number in a fraction tells how many equal parts the whole or unit is divided into, the top number tells how many equal parts are indicated); identify model of one half and one fourth; indicate that the more parts a whole is divided into the smaller the pieces of the whole; identify numeric symbols for ½ and ¼. **Big Idea:** Fractions are special numbers that represent the relationship between parts and whole. **Essential Questions:** How can this shape or set be divided into smaller equal parts? What does the bottom number in a fraction tell me? What does the top number in a fraction tell me? How do I know how many fractional parts make a whole? How do I partition this shape so the fraction ½ or ¼ is represented?
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.		

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Fourth Grade Mathematics: Number and Operations—Fractions		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**EE.4.NF.3.** Differentiate between whole and half.	**Concept:** Fractions are parts of wholes. **Skills:** Indicate shapes that have not been divided into equal parts; indicate shapes that have been divided into 2 equal parts. **Big Idea:** A fraction represents equal parts of a whole. **Essential Questions:** How can this whole be broken in half? How many parts of the object make up the whole of the object?
4.NF.3.a. Understand addition and subtraction of fractions as joining and separating parts.		
4.NF.3.b. 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.		
4.NF.3.c. 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.		
4.NF.3.d. 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.		

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Fourth Grade Mathematics: Number and Operations—Fractions		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Build fractions from unit fractions by applying and extending previous understanding of operations on whole numbers		
4.NF.4. Apply and extend previous understandings of multiplication to multiply a fraction by a whole number.	**Not applicable.** See EE.4.OA.1–2 and EE.5.NBT.5.	
4.NF.4.a. 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).		
4.NF.4.b. 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.)		
4.NF.4.c. 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?		

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Fourth Grade Mathematics: Number and Operations—Fractions		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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 100.17 For example, express 3/10 as 30/100, and add 3/10 + 4/100 = 34/100.	**Not applicable. See EE.7.NS.2.c-d.**	**Not applicable.**
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.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.		

Fourth Grade Mathematics: Measurement and Data		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Solve 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), ...	**EE.4.MD.1.** Identify the smaller measurement unit that comprises a larger unit within a measurement system (inches/foot, centimeter/meter, minutes/hour).	**Concept:** Measurement involves a selected attribute (e.g., time, length, mass, volume, money, area) and a comparison of the attribute being measured against a unit of the same attribute. **Skills:** Identify the smaller unit that relates to the larger unit (e.g., inches to feet); use the same unit of measure when comparing measurements; round up to nearest hour; identify time on digital clock; identify hour hand and minute hand on analog clock; identify mass as measurement of matter/weight; use a scale to measure mass; identify volume as a measurement of liquid; use cups or ounces to measure volume; compare lengths of objects; identify coins and their value; use unit square to measure square and rectangle.

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Fourth Grade Mathematics: Measurement and Data		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit		
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.	**EE.4.MD.2.a.** Tell time using a digital clock. Tell time to the nearest hour using an analog clock.	**Big Idea:** The larger the unit of measure, the fewer units it takes to measure the attribute. **Essential Questions:** What tools and units are used to measure the attributes of an object? How do I choose the appropriate tool and unit when measuring? How are the units of measure within a standard system related? How do I measure accurately? How do I find area, mass, and volume of geometric figures? What tools and units are used to measure the attributes of time? Why is telling time important? How do I use a clock to tell time to the nearest hour? How can I tell time using both digital and analog clocks? Why is it important to understand the value of coins?
	EE.4.MD.2.b. Measure mass or volume using standard tools.	
	EE.4.MD.2.c. Use standard measurement to compare lengths of objects.	
	EE.4.MD.2.d. Identify coins (penny, nickel, dime, quarter) and their values.	
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.	**EE.4.MD.3.** Determine the area of a square or rectangle by counting units of measure (unit squares).	

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Fourth Grade Mathematics: Measurement and Data		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**EE.4.MD.4.a.** Represent data on a picture or bar graph given a model and a graph to complete.	**Concept:** Data can be represented and organized in order to answer questions and solve problems. **Skills:** Sort objects or pictures into categories based on one common attribute; record sorted categories using marks, stamps, pictures, etc. with each symbol used representing one data object; label graph; use data to create picture graph; use data to create bar graph; answer questions about the sorted sets (e.g., Which has more? Which has less? How many are their all together?); answer question(s) using the information represented in the sorted sets. **Big Idea:** The way data is displayed or organized influences interpretation. **Essential Questions:** Why are graphs helpful? What kinds of questions can be answered using picture or bar graph? Can I sort or organize this data in different ways? Why is data collected and analyzed? How can information be gathered, recorded, and organized? How does collecting data help me solve problems or make decisions? How do labels help others understand the data?
	EE.4.MD.4.b. Interpret data from a picture or bar graph.	

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Fourth Grade Mathematics: Measurement and Data		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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:	**EE.4.MD.5.** Recognize angles in geometric shapes.	**Concept:** Shapes can be described and classified according to their attributes. **Skills:** Recognize a line; recognize a ray; recognize a line segment; recognize a point on a geometric shape; identify an angle as a figure formed by two rays sharing one endpoint; compare two or more angles as larger or smaller. **Big Idea:** Angles are geometric shapes that have a common end point and can be measured. **Essential Questions:** Where are the lines, rays, line segments, points, and angles on these shapes? Which angle is larger? Which angle is smaller?
4.MD.5.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.		
4.MD.5.b. An angle that turns through n one-degree angles is said to have an angle measure of n degrees.		
4.MD.6. Measure angles in whole-number degrees using a protractor. Sketch angles of specified measure.	**EE.4.MD.6.** Identify angles as larger and smaller.	

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Fourth Grade Mathematics: Measurement and Data		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Geometric measurement: understand concepts of angle and measure angles		
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.	**Not applicable.** See EE.4.G.2.a.	

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Fourth Grade Mathematics: Geometry		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**EE.4.G.1.** Recognize parallel lines and intersecting lines.	**Concept:** Shapes can be described and classified by their attributes. **Skills:** Recognize a line; recognize a line segment; recognize the difference between intersecting and parallel lines; describe attributes of two-dimensional shapes; identify lines of symmetry that partition a shape into equal areas. **Big Idea:** Shapes can be defined by different types of lines. **Essential Questions:** What are parallel lines? Where do I see parallel lines in my environment? What are intersecting lines? Where do I see intersecting lines in my environment? How many lines does this shape have? How many angles does this shape have? Is this a line of symmetry? Is this shape divided into equal parts?
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.	**EE.4.G.2.** Describe the defining attributes of two- dimensional shapes.	
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.	**EE.4.G.3.** Recognize that lines of symmetry partition shapes into equal areas.	

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Fifth Grade Mathematics: Operations and Algebraic Thinking		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Write and interpret numerical expressions		
5.OA.1. Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols.	**Not applicable.**	**Not applicable.**
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.		

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Fifth Grade Mathematics: Operations and Algebraic Thinking		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**EE.5.OA.3.** Identify and extend numerical patterns.	**Concept:** Patterns help us see relationships, make connections between concepts, and make predictions. **Skills:** Identify pattern as shrinking or growing; identify rule of pattern; apply the rule to extend the pattern. **Big Idea:** Numerical patterns are predictable as they shrink and grow. Numbers are interconnected and have relationships with other numbers. **Essential Questions:** How can you extend the numerical pattern? What is the rule of the pattern?

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Fifth Grade Mathematics: Numbers and Operations in Base Ten		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**EE.5.NBT.1.** Compare numbers up to 99 using base ten models.	**Concept:** The value of a digit depends on its place, or position in the number. **Skills:** Compare numbers using base-ten models; group objects into tens once the count exceeds 9; group objects into sets of tens of tens (1 group of one hundred) when it exceeds 99; identify the patterns in the numbers themselves (e.g., 10, 20, 30, . . . follows the same pattern as 1, 2, 3, ...); identify place value of 2-digit numbers ending in zero; compare the place value of numbers ending in zero(s); compare whole numbers using symbols (<, >, =); round two-digit whole numbers to the nearest 10.
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.	**EE.5.NBT.2.** Use the number of zeros in numbers that are powers of 10 to determine which values are equal, greater than, or less than.	

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Fifth Grade Mathematics: Numbers and Operations in Base Ten		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Understand the place value system		
5.NBT.3. Read, write, and compare decimals to thousandths.	**EE.5.NBT.3.** Compare whole numbers up to 100 using symbols (<, >, =).	**Big Idea:** Place value is important when comparing numbers. **Essential Questions:** What do I know about these numbers? Are the numbers <, >, or = to each other? How can I use place value to determine what number is <, >, or = to another number? How does the number of zeros in a number affect its value? When I solve this problem, do I need an exact answer or an estimate? What are the benchmarks on either side of the number I want to round? What is the midpoint? Should I round up or down?
5.NBT.3.a. Read and write decimals to thousandths using base-ten numerals, number names, and expanded form, e.g., 347.392 = 3 × 100 + 4 × 10 + 7 × 1 + 3 × (1/10) + 9 × (1/100) + 2 × (1/1000).		
5.NBT.3.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.	**EE.5.NBT.4.** Round two-digit whole numbers to the nearest 10 from 0-90.	

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Fifth Grade Mathematics: Numbers and Operations in Base Ten		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**EE.5.NBT.5.** Multiply whole numbers up to 5 × 5.	**Concept:** Mathematical problems can be solved using different mathematical operations. **Skills:** Make equal groups up to 5 (5 groups with 5 in each group); find product of whole numbers up to 5; use repeated addition to find product; use array module to find product; use skip counting (2's and 5's) to find product; use the properties of multiplication when solving equations (commutative and identity); partition whole sets into smaller equal sized sets. **Big Idea:** Division facts can be found by thinking about the related multiplication fact. **Essential Questions:** What are the mathematical properties for multiplication? How would I use them? What strategies can I use when solving multiplication and division problems? How can I use what I know about skip counting to help me find the product? How can I use what I know about sharing fairly or equally to solve division problems? How can I use what I know about multiplication to help me solve division problems?
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.	**EE.5.NBT.6–7.** Illustrate the concept of division using fair and equal shares.	
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.		

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Fifth Grade Mathematics: Number and Operations—Fractions		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Generalize place value understanding for multi-digit whole numbers		
5.NF.1. Add and subtract fractions with unlike denominators (including mixed numbers) by replacing given fractions with equivalent fractions in such a way s 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.)	**EE.5.NF.1.** Identify models of halves (1/2, 2/2) and fourths (1/4, 2/4, 3/4, 4/4).	**Concept:** Fractions can mean different things and be modeled in different ways: part of a set, part of a region, and as a measure. **Skills:** Identify the meaning of the numerator and denominator; identify models (area or set) of halves, fourths, thirds, and tenths; indicate that the more parts a whole is divided into, the smaller the parts will be; identify numeric symbols for halves, fourths, thirds, and tenths. **Big Idea:** Fractions are special numbers that represent the relationship between parts and whole. **Essential Questions:** How can this shape or set be divided into smaller equal parts? What does the bottom number in a fraction tell me? What does the top number in a fraction tell me? How do I know how many fractional parts make a whole? How do I partition this shape so the fraction __ is represented?
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.	**EE.5.NF.2.** Identify models of thirds (1/3. 2/3, 3/3) and tenths (1/10, 2/10, 3/10, 4/10, 5/10, 6/10, 7/10, 8/10, 9/10, 10/10).	

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Fifth Grade Mathematics: Number and Operations—Fractions		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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?	**Not applicable.** See EE.6.RP.1.	**Not Applicable.**

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Fifth Grade Mathematics: Number and Operations—Fractions		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Apply and extend previous understandings of multiplication and division to multiply and divide fractions		
5.NF.4. Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction.	**Not applicable.**	**Not applicable.**
5.NF.4.a. Interpret the product (a/b) × q as a parts of a partition of q into b equal parts; equivalently, as the result of a sequence of operations a × 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.)		
5.NF.4.b. 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.		

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Fifth Grade Mathematics: Number and Operations—Fractions		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Apply and extend previous understandings of multiplication and division to multiply and divide fractions		
5.NF.5. Interpret multiplication as scaling (resizing), by:	**Not applicable.**	**Not applicable.**
5.NF.5.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.		
5.NF.5.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 × a)/(n × b) to the effect of multiplying a/b by 1.		
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	**Not applicable.** See EE.10.N-CN.2.b.	

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Fifth Grade Mathematics: Number and Operations—Fractions		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Apply and extend previous understandings of multiplication and division to multiply and divide fractions		
5.NF.7. Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions.	**Not applicable.** See EE.7.NS.2.b.	**Not applicable.**
5.NF.7.a. 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.		
5.NF.7.b. 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.		

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Fifth Grade Mathematics: Number and Operations—Fractions		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Apply and extend previous understandings of multiplication and division to multiply and divide fractions		
5.NF.7.c. 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?	**Not applicable.** See EE.7.NS.2.b.	**Not applicable.**

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Fifth Grade Mathematics: Measurement and Data		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**EE.5.MD.1.a.** Tell time using an analog or digital clock to the half or quarter hour.	**Concept:** Measurement involves a selected attribute (e.g., time, length, mass, volume, money) and a comparison of the attribute being measured against a unit of the same attribute. **Skills:** Tell time using an analog and digital clock to the half and quarter hour; use standard units to measure weight and length of objects; count the value of a collection of coins; indicate coins needed to equal the value of another coin (e.g., 2 nickels make one dime, two dimes and one nickel make one quarter). **Big Idea:** The larger the unit of measure, the fewer units it takes to measure the attribute. **Essential Questions:** Why is telling time important? How do I use a clock to tell time to the nearest hour, half hour, or quarter hour? How can I tell time using both digital and analog clocks? What tools and units are used to measure the attributes of an object? How do I choose the appropriate tool and unit when measuring? How can I measure the length of this object accurately? Why is it important to understand the values of coins? How can I represent the same amount of money using different combinations of coins? How can I combine coins to make them easier to count? What coins can I use to give me the same value as a nickel? Dime? Quarter? Half dollar?
	EE.5.MD.1.b. Use standard units to measure weight and length of objects.	
	EE.5.MD.1.c. Indicate relative value of collections of coins.	

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Fifth Grade Mathematics: Measurement and Data		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**EE.5.MD.2.** Represent and interpret data on a picture, line plot, or bar graph.	**Concept:** Data can be represented and organized to answer questions and solve problems. **Skills:** Sort objects or pictures into two or three categories based on one common attribute; record sorted categories using marks, stamps, pictures, etc. with each symbol used representing one data object; label graph; use data to create picture graph; use data to create bar graph; use data to create a line plot; answer questions about the sorted sets (e.g., Which has more? Which has less? How many are their all together?); answer question(s) using the information represented in the sorted sets. **Big Idea:** The way data is displayed or organized influences interpretation. **Essential Questions:** Why are graphs helpful? What kinds of questions can be answered using picture, bar graph, or line plot? Can I sort or organize this data in different ways? Why is data collected and analyzed? How can information be gathered, recorded, and organized? How does collecting data help me solve problems or make decisions? How do labels help others understand the data?

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Fifth Grade Mathematics: Measurement and Data		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Geometric measurement: understand concepts of volume, and relate volume to multiplication and to addition		
5.MD.3. Recognize volume as an attribute of solid figures and understand concepts of volume measurement.	**EE.5.MD.3.** Identify common three-dimensional shapes.	**Concept:** Shapes can be described, classified, and analyzed by their attributes. **Skills:** Identify a cube, cone, sphere, pyramid, prism, and cylinder; identify name of cube, cone, sphere, pyramid, prism, and cylinder; match shapes with same size and different orientation, match shapes with different size an different orientation, match shapes with same size and same orientation. **Big Idea:** Many of the properties and attributes that apply to 2-D shapes also apply to 3-D shapes. **Essential Questions:** Where in the real world can I find this shape? How can I identify and describe solid figures by describing the faces, edges, and sides? What is the name of this shape? Are these shapes similar, if so how? Are these shapes different, if so how?
5.MD.3.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.		
5.MD.3.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.		

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Fifth Grade Mathematics: Measurement and Data		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Geometric measurement: understand concepts of volume, and relate volume to multiplication and to addition		
5.MD.4. Measure volumes by counting unit cubes, using cubic cm, cubic in., cubic ft, and improvised units.	**EE.5.MD.4–5.** Determine the volume of a rectangular prism by counting units of measure (unit cubes).	**Concept:** Shapes can be described, classified, and analyzed by their attributes. **Skills:** Identify a unit cube; identify a rectangular prism; define volume as the amount of space inside a three dimensional shape; fill and count a rectangular prism with unit cubes; describe the total as the volume of the rectangular prism. **Big Idea:** Volume is a unique attribute of solids that explains how much space an object takes up. **Essential Questions:** What unit of measure do I use to measure the volume of a rectangular prism? What strategy can I use to determine the volume of any rectangular prism? How can I describe the volume of a shape?
5.MD.5. Relate volume to the operations of multiplication and addition, and solve real-world and mathematical problems involving volume.		
5.MD.5.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. Represent threefold whole-number products as volumes, e.g., to represent the associative property of multiplication.		
5.MD.5.b. Apply the formulas V = l × w × h and V = b × h for rectangular prisms to find volumes of right rectangular prisms wit whole-number edge lengths in the context of solving real-world and mathematical problems.		

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Fifth Grade Mathematics: Measurement and Data		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Geometric measurement: understand concepts of volume, and relate volume to multiplication and to addition		
5.MD.5.c. 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.	**See above.**	**See above.**

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Fifth Grade Mathematics: Geometry		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Graph points on the coordinate plane to solve real-world and mathematical problems		
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).	**EE.5.G.1-4.** Sort two-dimensional figures and identify the attributes (angles, number of sides, corners, color) they have in common.	**Concept:** Shapes can be described and classified according to their attributes. **Skills:** Identify angles, number of sides, corners (right angles) and color of two-dimensional figures; analyze figures to identify common attributes; compare angles within figures as more than, less than, or equal; compare number of sides of figures using more than, less than or equal; compare the number of right angles in figures using more than, less than or equal; sort two-dimensional figures based on attributes. **Big Idea:** Two-dimensional figures can be compared using ideas such as greater than, less than, and equal. **Essential Questions:** What attributes do the figures have in common? How can I sort these figures in different ways? What attribute am I going to use to classify this group of objects?
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.		

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Fifth Grade Mathematics: Geometry		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**EE.5.G.1-4.** Sort two-dimensional figures and identify the attributes (angles, number of sides, corners, color) they have in common.	**See Above.**
5.G.4. Classify two-dimensional figures in a hierarchy based on properties.		

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Sixth Grade Mathematics: Ratios and Proportional Relationships		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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."	**EE.6.RP.1.** Demonstrate a simple ratio relationship.	**Concept:** Ratios compare values. **Skills:** Recognize and represent many (part to part, part to whole) to 1 ratio. **Big Idea:** A ratio tells how much of one thing there is compared to how much of another thing. A ratio compares two quantities-part to part or part to whole. **Essential Questions:** What is a ratio? How can I write a ratio? What am I comparing? What does this ratio tell me? How many parts are there in the whole? What does the ratio represent?
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 i 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."	**Not applicable.** See EE.7.RP.1–3.	
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.	**Not applicable.** See EE.8.F.1–3.	

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Sixth Grade Mathematics: Ratios and Proportional Relationships		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Understand ratio concepts, and use ratio reasoning to solve problems		
6.RP.3.a. Make tables of equivalent ratios relating quantities with whole- measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios.	**Not applicable.** See EE.8.F.1–3.	**See above.**
6.RP.3.b. 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?		
6.RP.3.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 whole, given a part and the percent.		
6.RP.3.d. Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.		

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Sixth Grade Mathematics: The Number System		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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?	**EE.6.NS.1.** Compare the relationships between two unit fractions.	**Concept:** Fractions can mean different things and be modeled in different ways: part of a set, part of a region, and as a measure. **Skills:** Identify that a unit fraction is one part of a whole; indicate that the more parts a whole is divided into, the smaller the parts will be; use partitioning and iterations to represent the unit fractions; compare two unit fractions. **Big Idea:** A fractional part is equal to, less than, or greater than one whole. **Essential Questions:** How can I represent these fractions? What is the relationship between the two fractions? Are they equivalent? Which fraction is larger/smaller?

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Sixth Grade Mathematics: The Number System		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Compute fluently with multi-digit numbers, and find common factors and multiples		
6.NS.2. Fluently divide multi-digit numbers using the standard algorithm.	**EE.6.NS.2.** Apply the concept of fair share and equal shares to divide.	**Concept:** Problems can be solved using various operations. **Skills:** Use the values in a division equation to find the number of groups that can be made or the number of items in each group using the strategy of fair or equal shares; solve multiplication problems using 2 values whose product is less than or equal to 50; use concrete objects to prove the answer; use a calculator to prove the answer. **Big Idea:** Some problems involving joining equal groups, separating equal groups, comparison, or combinations can be solved using multiplication; others can be solved using division. **Essential Questions:** How can I make equal groups from this one large group? How do I know this is a fair share? What is the product? How can I solve this multiplication/division problem using objects? How can I solve this multiplication/division problem using a calculator?
6.NS.3. Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.	**EE.6.NS.3.** Solve two-factor multiplication problems with products up to 50 using concrete objects and/or a calculator.	
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).	**Not applicable.**	

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Sixth Grade Mathematics: The Number System		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Apply and extend previous understandings of numbers to the system of rational numbers		
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.	**EE.6.NS.5–8.** Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero).	**Concept:** Both positive and negative numbers represent a distance from zero on the number line. **Skills:** Identify positive and negative numbers on a number line; identify real- world examples for the use of positive and negative numbers (e.g., temperature, owing money, working with a budget, elevations below sea level, the basement floor of a building, diving under water); explain that zero is the value between positive and negative numbers; show the direction of movement on a number line when working with positive and negative numbers. **Big Idea:** Positive numbers are greater than zero. Negative numbers are less than zero and have a negative sign (−) in front of them. A negative number is the opposite of a positive number of the same size. **Essential Questions:** Where can I find this number on a number line? Does this number have a positive or negative value? What are some examples I can use to show negative and positive numbers? If I start with a positive number and then add a negative number, what direction on the number line will I move? How far is this number from zero?
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.6.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, e.g., –(–3) = 3, and that 0 is its own opposite.		

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Sixth Grade Mathematics: The Number System		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Apply and extend previous understandings of numbers to the system of rational numbers		
6.NS.6.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.	**See above.**	**Same as above.**
6.NS.6.c. 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.		

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Sixth Grade Mathematics: The Number System		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Apply and extend previous understandings of numbers to the system of rational numbers		
6.NS.7. Understand ordering and absolute value of rational numbers.	**EE.6.NS.5–8.** Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero).	**Same as above.**
6.NS.7.a. 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.		
6.NS.7.b. Write, interpret, and explain statements of order for rational number in real-world contexts. For example, write –30C > –70 C to express the fact that –30C is warmer than –70C.		
6.NS.7.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 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.		
6.NS.7.d. 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.		

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Sixth Grade Mathematics: The Number System		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Apply and extend previous understandings of numbers to the system of rational numbers		
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.	**See above.**	**Same as above.**

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Sixth Grade Mathematics: Expressions and Equations		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Apply and extend previous understandings of arithmetic to algebraic expressions		
6.EE.1. Write and evaluate numerical expressions involving whole-number exponents.	**EE.6.EE.1–2.** Identify equivalent number sentences.	**Concept:** Number sentences and equations show a relationship and can be written in different ways. **Skills:** Recognize equivalent algebraic expressions; represent the unknown in an equation; use properties of operation to generate equivalent expressions involving addition, subtraction, multiplication or division; identify equivalent number sentences; use symbols for equal and not equal. **Big Idea:** A number sentence uses numbers and the equal sign to show that two quantities have equal value, whereas a number expression is a math problem that uses numbers and letters to represent variables and an equals sign to show that two quantities have equal value. **Essential Questions:** Do the two sides of this problem have equal value? Is this expression true (equal) or false (not equal)?
6.EE.2. Write, read, and evaluate expressions in which letters stand for numbers.		
6.EE.2.a. 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.		

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Sixth Grade Mathematics: Expressions and Equations		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Apply and extend previous understandings of arithmetic to algebraic expressions		
6.EE.2.b. 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.	**See above.**	**See above.**
6.EE.2.c. 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 = 6s2 to find the volume and surface area of a cube with sides of length s = 1/2.		
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 he 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.	**EE.6.EE.3.** Apply the properties of addition to identify equivalent numerical expressions.	

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Sixth Grade Mathematics: Expressions and Equations		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Apply and extend previous understandings of arithmetic to algebraic expressions		
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.	**Not applicable.**	

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Sixth Grade Mathematics: Expressions and Equations		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Reason about and solve one-variable equations and inequalities		
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.	**EE.6.EE.5–7.** Match an equation to a real-world problem in which variables are used to represent numbers.	**Concept:** Mathematical situations and structures can be translated and represented abstractly using variables, expressions, and equations. **Skills:** Identify what operation is needed in the real-world problem; identify the known quantities and the unknown variable; identify the structure of the equation; match an equation to a real world-problem. **Big Idea:** Letters are used in mathematics to represent generalized properties, unknowns in equations, and relationships between quantities. **Essential Questions:** What operation is needed in this problem? What are the known quantities and the unknown variable in the problem? What does the variable represent? Which equations matches this problem?
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.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.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.	**Not applicable.**	

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Sixth Grade Mathematics: Expressions and Equations		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Represent and analyze quantitative relationships between dependent and independent variables		
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.	**Not applicable.**	**Not applicable.**

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Sixth Grade Mathematics: Geometry		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacke**
Solve real-world and mathematical problems involving area, surface area, and volume		
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.	**EE.6.G.1.** Solve real-world and mathematical problems about area using unit squares.	**Concept:** Measurement involves a selected attribute of an object (e.g., area, volume) and a comparison of the object being measured against a unit of the same attribute. **Skills:** Identify contexts for using unit squares (area) and unit cubes (volume); use unit squares and unit cubes to count the total; apply knowledge of repeated addition to solve for volume; apply knowledge of multiplication to solve for volume; solve a real-world problem involving area; solve a real-world problem involving volume. **Big Idea:** The use of standard measurement units simplifies communication about the size of objects.
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 = lwh and V = bh to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems.	**EE.6.G.2.** Solve real-world and mathematical problems about volume using unit cubes.	
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.	**Not applicable.**	

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Sixth Grade Mathematics: Geometry		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Solve real-world and mathematical problems involving area, surface area, and volume		
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.	**Not applicable.**	**Essential Questions:** What is the difference between area and volume? How do I know when to use unit cubes or unit squares? How can I organize the information to solve for area and/or volume? What is the area? What is the volume?

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Sixth Grade Mathematics: Statistics and Probability		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**EE.6.SP.1–**2. Display data on a graph or table that shows variability in the data.	**Concept:** Information can be collected, displayed, summarized, and analyzed. **Skills:** Identify the question the data needs to answer; determine an appropriate display for data (line plot, bar graph, picture graph, table); recognize and summarize data by overall shape (increasing, decreasing, staying the same); recognize outliers and peaks in data distribution. **Big Idea:** It is important not only to read information from graphs but to make inferences, draw conclusions, and make predictions. **Essential Questions:** What is the overall shape of the data? What data is an outlier? Why does this type of graph represent the data the best?
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.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.	**Not applicable.** See EE.S-ID.4.	

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Sixth Grade Mathematics: Statistics and Probability		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacke**
Summarize and describe		
6.SP.4. Display numerical data in plots on a number line, including dot plots, histograms, and box plots.	**Not applicable.** See EE.6.SP.1–2.	**Concept:** Information can be collected, displayed, summarized and analyzed. **Skills:** Summarize data by overall shape; identify outliers; identify most common value; identify the middle value; identify highest and lowest value; identify peaks in data distribution; identify symmetric distribution (data is balanced on both sides of the mean). **Big Idea:** It is important not only to read information from graphs but to make inferences, draw conclusions, and make predictions. **Essential Questions:** What is the shape of the data? How is the data in this graph the same? How is the data in this graph different? Does this data have a pattern and if so, what is the pattern? How is this data distributed? How could I summarize my interpretation of the data?
6.SP.5. Summarize numerical data sets in relation to their context, such as by:	**EE.6.SP.5.** Summarize data distributions shown in graphs or tables.	
6.SP.5.a. Reporting the number of observations		
6.SP.5.b. Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.		
6.SP.5.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.		
6.SP.5.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.		

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Seventh Grade Mathematics: Ratios and Proportional Relationships		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Analyze proportional relationships and use them to solve real-world and mathematical problems		
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.	**EE.7.RP.1–3.** Use a ratio to model or describe a relationship.	**Concept:** Ratios show a comparison and can be used for mathematical reasoning. **Skills:** Use ratio language "to" and "out of" to identify how much of one thing there is compared to another thing; write/indicate a ratio comparing part to part or part to whole. **Big Idea:** A ratio is used to describe a relationship to part-part or part-whole. **Essential Questions:** What does this ratio tel me? How can I model this relationship? How do you write a ratio that describes part to part or par to whole.
7.RP.2. Recognize and represent proportional relationships between quantities.		
7.RP.2.a. 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.		
7.RP.2.b. Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.		

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Seventh Grade Mathematics: Ratios and Proportional Relationships		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Analyze proportional relationships and use them to solve real-world and mathematical problems		
7.RP.2.c. 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.	**Same as above.**	**Same as above.**
7.RP.2.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.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.		

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Seventh Grade Mathematics: The Number System		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**EE.7.NS.1.** Add fractions with like denominators (halves, thirds, fourths, and tenths) with sums less than or equal to one.	**Concept:** Numbers can be represented, displayed, converted, and compared. **Skills:** Add fractions with like denominators; solve multiplication problems; solve divisions problems; convert a fraction with denominator of 10 to a decimal; compare decimals in real-world examples. **Big Idea:** The concepts and properties of addition, subtraction, multiplication, and division are the same whether using whole numbers, fractions, or decimals. **Essential Questions:** What is the sum of two fractions? Which part of the fractions do I add? Why do I not add the denominators? What is the product of this multiplication problem? What model can I use to help me solve this multiplication problem? What are the parts of division problem? What model can I use to help me solve this division problem? How can I express a fraction as a decimal? Which tenth is larger/smaller (from a real world example)?
7.NS.1.a. 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.		
7.NS.1.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.		

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Seventh Grade Mathematics: The Number System		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers		
7.NS.1.c. 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.	**Same as above.**	**Same as above.**
7.NS.1.d. 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.	**EE.7.NS.2.a.** Solve multiplication problems with products to 100.	
7.NS.2.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.		

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Seventh Grade Mathematics: The Number System		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpack**
Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers		
7.NS.2.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.	**EE.7.NS.2.b.** Solve division problems with divisors up to five and also with a divisor of 10 without remainders.	**Same as above.**
7.NS.2.c. Apply properties of operations as strategies to multiply and divide rational numbers.	**EE.7.NS.2.c–d.** Express a fraction with a denominator of 10 as a decimal.	
7.NS.2.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.3. Solve real-world and mathematical problems involving the four operations with rational numbers.	**EE.7.NS.3.** Compare quantities represented as decimals in real-world examples to tenths.	

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Seventh Grade Mathematics: Number and Quantity – The Expressions and Equations		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**EE.7.EE.1.** Use the properties of operations as strategies to demonstrate that expressions are equivalent.	**Concept:** Operations create relationships between numbers. **Skills:** Apply the properties of operations (i.e., commutative, associative); recognize equivalent expressions (e.g., A + (B x C)= (C x B) + A, and (A+B) – C x (D x E)= (A+B) – (C x D) x E); identify arithmetic sequence with common difference (e.g., 5, 7, 9, 11, 13, 15 common difference of 2). **Big Idea:** The commutative and associative properties for addition and multiplication of whole numbers allow computations to be performed flexibly. Subtraction is not commutative or associative for whole numbers. The difference between successive terms in some sequences is constant. **Essential Questions:** What is the correct order for performing mathematical operations? How can the properties of operations be used to determine if two equations are equivalent? What is the difference between each of the numbers in this sequence? What is the rule for this sequence?
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.”	**EE.7.EE.2.** Identify an arithmetic sequence of whole numbers with a whole number common difference.	

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Seventh Grade Mathematics: The Number System		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Solve real-life and mathematical problems using numerical and algebraic expressions and equations		
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.	**Not applicable.**	**Concept:** Equality means that both values on the left and the right side of the equal sign '=' will have the same value. **Skills:** Use models to solve one step addition and subtraction equations (e.g., p + 12 = 12 + p, and p + 7 = 12 - 7). **Big Idea:** The expressions on each side of the equal sign are equal, so you can add the same value to each side and maintain the equality and you can subtract the same value from each side of an equation and maintain the equality. **Essential Questions:** What is meant by equality in mathematics? How can I use addition or subtraction to solve one-step equations? What information do we know from the equation? What information is missing? What operation could be used to find the solution? Which representation will I use to help me solve this problem (concrete manipulatives, pictures, words, or equations)?

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Seventh Grade Mathematics: The Number System		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Solve real-life and mathematical problems using numerical and algebraic expressions and equations		
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.	**EE.7.EE.4.** Use the concept of equality with models to solve one-step addition and subtraction equations.	**Same as above.**
7.EE.4.a. Solve word problems leading to equations o 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?		
7.EE.4.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. 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.		

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Seventh Grade Mathematics: Geometry		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**EE.7.G.1.** Match two similar geometric shapes that are proportional in size and in the same orientation.	**Concept:** Shapes can be described, classified and analyzed by their attributes. **Skills:** Match familiar shapes such as squares, rectangles, circles when presented with different size and same orientation; match familiar solids such as spheres, rectangular prisms, cubes, pyramids when presented with different size and same orientation; classify shapes with like attributes; describe attributes of shapes; match a two-dimensional shape with a three-dimensional shape that shares an attribute (e.g., identify a square in a cube, identify the circle in a cylinder). **Big Idea:** Many two dimensional shapes share attributes with three dimensional shapes. **Essential Questions:** How can I decide if two shapes are similar? What attributes do the shapes have? What attributes do these shapes have in common?
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.	**EE.7.G.2.** Recognize geometric shapes with given conditions.	
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.	**EE.7.G.3.** Match a two-dimensional shape with a three-dimensional shape that shares an attribute.	

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Seventh Grade Mathematics: Geometry		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Solve real-life and mathematical problems 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.	**EE.7.G4.** Determine the perimeter of a rectangle by adding the measures of the sides.	**Concept:** Units of measure can be used to solve real world problems. **Skills:** Calculate the perimeter of a rectangle; classify angles by size (right, acute and obtuse); calculate the area of a rectangle; use tiles to confirm the area of a rectangle; use partitioning to confirm the area of a rectangle. **Big Idea:** Formulas are used to calculate perimeter and area. The name of an angle describes its attribute. **Essential Questions:** How do I calculate perimeter? How do I calculate area? How is perimeter measured? How is area measured? How can I use the right angle to help me compare and classify other angles? How do I classify an angle? How can I confirm by calculations for area?
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.	**EE.7.G.5.** Recognize angles that are acute, obtuse, and right.	
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.	**EE.7.G.6.** Determine the area of a rectangle using the formula for length × width, and confirm the result using tiling or partitioning into unit squares.	

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Seventh Grade Mathematics: Statistics and Probability		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**EE.7.SP.1–2.** Answer a question related to the collected data from an experiment, given a model of data, or from data collected by the student.	**Concept:** Information can be collected, displayed, summarized and analyzed. **Skills:** Use data to answer a question; interpret data from an experiment; interpret data from a model; interpret collected data. **Big Idea:** Data can be used to answer questions. **Essential Questions:** What data has been collected? What is the question I am trying to answer about the data? What does that data mean to me? What conclusions can I draw from the data? What do I want to say to answer the question?
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.		

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Seventh Grade Mathematics: Statistics and Probability		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**EE.7.SP.3.** Compare two sets of data within a single data display such as a picture graph, line plot, or bar graph.	**Concept:** Information can be collected, displayed, summarized and analyzed. **Skills:** Read, interpret, and draw conclusions from data, presented in picture graphs, line plots, and bar graphs; use visual overlap of two sets of data to compare their variability; compare differences in shape of 2 sets of data; use comparative language such as more/less/equal. **Big Idea:** Data can be represented visually using tables, charts, and graphs. The type of data determines the best choice of visual representation. **Essential Questions:** What is this data telling me? What does this data represent? What comparisons or conclusions can you make from the data?
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.	**Not applicable.** See EE.S-ID.4.	

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Seventh Grade Mathematics: Statistics and Probability		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Investigate chance processes, and develop, use, and evaluate probability models		
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.	**EE.7.SP.5–7.** Describe the probability of events occurring as possible or impossible.	**Concept:** Probability can provide a basis for making predictions. **Skills:** Describe the likelihood of events by indicating possible and impossible; identify outcome of an event; predict the probability that a familiar event will occur or not occur (e.g., recess, snow, pencil falling). **Big Idea:** You can describe an event based on its probability (from certain to impossible). **Essential Questions:** What is the likelihood that the event will occur? What are the possible outcomes of the event?
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.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.		

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Seventh Grade Mathematics: Statistics and Probability		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Investigate chance processes, and develop, use, and evaluate probability models		
7.SP.7.a. 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.	**Not applicable.**	**Not applicable.**
7.SP.7.b. 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?		
7.SP.8. Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation.		
7.SP.8.a. 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.		

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Seventh Grade Mathematics: Statistics and Probability		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Investigate chance processes, and develop, use, and evaluate probability models		
7.SP.8.b. 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.	**Not applicable.**	**Not applicable.**
7.SP.8.c. 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?		

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Eighth Grade Mathematics: The Number System		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Know that there are numbers that are not rational, and approximate them by 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.	**EE.8.NS.1.** Subtract fractions with like denominators (halves, thirds, fourths, and tenths) with minuends less than or equal to one.	**Concept:** Division of whole into parts can be represented by fractions and decimals. **Skills:** Identify when two fractions are divided into an equal number of parts (like denominators); subtract fractions with like denominators; convert a fraction with denominator of 100 to a decimal; compare decimals in real-world examples. **Big Idea:** The concepts and properties of addition, subtraction, multiplication, and division are the same whether using whole numbers, fractions, or decimals. **Essential Questions:** What is the difference of two fractions? Which part of the fractions do I subtract? Why do I not subtract the denominators? How can I express a fraction as a decimal? Which hundredths is larger/smaller (from a real world example)?
	EE.8.NS.2.a. Express a fraction with a denominator of 100 as a decimal.	
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., π2). 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.	**EE.8.NS.2.b.** Compare quantities represented as decimals in real-world examples to hundredths.	

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Eighth Grade Mathematics: Expressions and Equations		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Work with radicals and integer exponents		
8.EE.1. Know and apply the properties of integer exponents to generate equivalent numerical expressions. For example, 32 × 3–5 = 3–3 = 1/33 = 1/27.	**EE.8.EE.1.** Identify the meaning of an exponent (limited to exponents of 2 and 3).	**Concept:** Numbers have relationships and can be written in different ways. **Skills:** Identify the base and exponent; use multiplication strategies to demonstrate the meaning of exponents; solve problems involving exponents of 2 or 3; multiply by the same number each time to get the next term in the geometric sequence (e.g., 3, 6, 12..., the common ratio is 2); compose and decompose whole numbers up to three digits. **Big Idea:** Exponents are notations of repeated multiplication. Geometric sequence represent multiplication or division by a common ratio (number). Numbers can be taken apart to create smaller groups or put together to create larger groups. **Essential Questions**: Which number is the exponent? How do I represent multiplication using exponents? How do I find the pattern of a geometric sequence? What is the common ratio between this sequence of numbers? How can I represent the same quantity in different ways?
8.EE.2. Use square root and cube root symbols to represent solutions to equations of the form x2 = p and x3 = 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.	**EE.8.EE.2.** Identify a geometric sequence of whole numbers with a whole number common ratio.	
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 × 108 and the population of the world as 7 × 109, and determine that the world population is more than 20 times larger.	**EE.8.EE.3–4.** Compose and decompose whole numbers up to 999.	

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Eighth Grade Mathematics: Expressions and Equations		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Work with radicals and integer exponents		
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.	**Same as above.**	**Same as above.**

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Eighth Grade Mathematics: Expressions and Equations		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**EE.8.EE.5–6.** Graph a simple ratio by connecting the origin to a point representing the ratio in the form of y/x. For example, when given a ratio in standard form (2:1), convert to 2/1, and plot the point (1,2).	**Concept:** Ratios show a comparison and can be used for mathematical reasoning. **Skills:** Identify a coordinate plane and its parts; identify the origin on a coordinate plane; identify the x value and the y value on a coordinate plane; identify that the x values move left and right, and the y value moves up and down; graph the points on the plane; given a ratio, identify which number goes on the x axis, and which number goes on the y axis. **Big Idea:** A ratio can be displayed on a graph to show a relationship between horizontal and vertical axis. **Essential Questions:** What are the parts of the coordinate plane? Where is the origin? Where is the x value and the y value on a coordinate plane? Which value moves left and right? Which value moves up and down? Where would this ratio be located on the coordinate plane? Given a ratio, which number represents the y value, and which number represents the x value?
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.		

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Eighth Grade Mathematics: Expressions and Equations		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Analyze and solve linear equations and pairs of simultaneous linear equations		
8.EE.7. Solve linear equations in one variable.	**EE.8.EE.7.** Solve simple algebraic equations with one variable using addition and subtraction.	**Concept:** Equations express a relationship that can be used to solve an unknown. **Skills:** Determine the unknown in an equation; use property of inverse operation (addition/subtraction) to complete the inverse to each side of the equation; isolate the variable to solve; solve algebraic expressions using addition or subtraction. **Big Idea:** Variables represent the unknown in an equation. **Essential Questions:** What am I trying to figure out in this equation? What do I know about the properties of addition and subtraction that can help me solve this problem?
8.EE.7.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.7.b. Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.		

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Eighth Grade Mathematics: Expressions and Equations		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Analyze and solve linear equations and pairs of simultaneous linear equations		
8.EE.8. Analyze and solve pairs of simultaneous linear equations.	**Not applicable.** See EE.8.EE.5–6.	**Not applicable.**
8.EE.8.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.		
8.EE.8.b. 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.		
8.EE.8.c. 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.		

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Eighth Grade Mathematics: Functions		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**EE.8.F.1–3.** Given a function table containing at least 2 complete ordered pairs, identify a missing number that completes another ordered pair (limited to linear functions).	**Concept:** A function is a mathematical rule that describes how two or more quantities vary in relationship to each other. **Skills:** Identify the relationship between the input and output (the pattern); identify the change (function or rule); use mathematical strategies to "find" the missing number; identify the missing number. **Big Idea:** In mathematical relationships, the value for one quantity depends on the value of the other quantity. Known values in a function table (pattern) can be used to predict other values. **Essential Questions:** What is the constant change? What rule can express this change? How can I use a rule to find additional ordered pairs (values)? What is the next set of ordered pairs?
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.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 = s2 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.		

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Eighth Grade Mathematics: Functions		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacke**
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.	**EE.8.F.4.** Determine the values or rule of a function using a graph or a table.	**Concept:** In mathematical relationships, the value for one quantity depends on the value of the other quantity. **Skills:** Given the input values and a rule, compute the output; describe the function rule from the list of ordered pairs given in a table or graph; describe the relationship between two quantities on a graph. **Big Idea:** The graph of a relationship can be analyzed with regard to the change in one quantity relative to the change in the other quantity. **Essential Questions:** How can I use the ordered pairs to figure out the rule? How can I use the values represented on a graph to figure out the rule? How can I use the rule to figure out the next ordered pair or the next plot on the graph? How can I describe the relationship between two quantities on a graph?
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.	**EE.8.F.5.** Describe how a graph represents a relationship between two quantities.	

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Eighth Grade Mathematics: Geometry		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Understand congruence and similarity using physical models, transparencies, or geometry software		
8.G.1. Verify experimentally the properties of rotations, reflections, and translations:	**EE.8.G.1.** Recognize translations, rotations, and reflections of shapes.	**Concept:** Shapes can be described, classified and analyzed by their attributes. **Skills:** Identify translation (slide), rotation (turning around a point), and reflection (flip) of shapes; describe properties of congruence; identify shapes that are congruent; describe properties of similar shapes; recognize similar shapes without rotation; compare angle to right angle-describe as greater than, less than or congruent to right angle. **Big Idea:** Shapes have attributes that do not change despite their orientation. **Essential Questions:** What do I know about shapes and their attributes? What happens to a shape if I slide it (translate)? What happens to a shape when I rotate it? What happens to a shape when I flip it? What makes two shapes similar? What makes two shapes congruent? How does this angle compare to a right angle?
8.G.1.a. Lines are taken to lines, and line segments to line segments of the same length.		
8.G.1.b. Angles are taken to angles of the same measure.		
8.G.1.c. Parallel lines are taken to parallel lines.		
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.	**EE.8.G.2.** Identify shapes that are congruent.	

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Eighth Grade Mathematics: Geometry		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Understand congruence and similarity using physical models, transparencies, or geometry software		
8.G.3. Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.	**Not applicable.**	
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.	**EE.8.G.4.** Identify similar shapes with and without rotation.	
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.	**EE.8.G.5.** Compare any angle to a right angle, and describe the angle as greater than, less than, or congruent to a right angle.	

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Eighth Grade Mathematics: Geometry		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Understand and apply the Pythagorean Theorem		
8.G.6. Explain a proof of the Pythagorean Theorem and its converse.	**Not applicable.**	**Not applicable.**
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.8. Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.		

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Eighth Grade Mathematics: Geometry		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Understand and apply the Pythagorean Theorem		
8.G.9. Know the formulas for the volumes of cones, cylinders, and spheres, and use them to solve real-world and mathematical problems.	**EE.8.G.9.** Use the formulas for perimeter, area, and volume to solve real-world and mathematical problems (limited to perimeter and area of rectangles and volume of rectangular prisms).	**Concept:** Measurement can be applied to solve real world problems. **Skills:** Identify formula for area; identify formula for perimeter; identify formula for volume; calculate the area of a shape; calculate perimeter of a shape; calculate volume of a shape; use formulas for area, perimeter, and volume to solve real-world problems. **Big Idea:** Measurement involves a selected attribute of an object (area, perimeter, volume) and calculating the attribute based on the measurements and formula. **Essential Questions:** What is this problem asking me to find? What formula do I use to solve this problem? What makes each formula different? Where do I use the formula for perimeter in real life? Where do I use the formula for area in real life? Where do I use the formula for volume in real life? Why is knowing the perimeter, area, and/or volume important?

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Eighth Grade Mathematics: Statistics and Probability		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**Not applicable.**	**Concept:** Information can be collected, displayed, summarized and analyzed. **Skills:** Decide what data will be represented; construct a graph or table from given categorical data; compare data categorized in the graph or table. **Big Idea:** Data can be displayed in a graph or table to be compared. Data can be used to answer questions. **Essential Questions:** How can this data be displayed in a graph? How can this data be displayed in a table? What comparisons can be made from the data? How would I describe the comparison of the data?
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.	**Not applicable.** See EE.10.S-ID.1–2 and EE.10.S-ID.3.	
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.	**Not applicable.**	

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Eighth Grade Mathematics: Statistics and Probability		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Investigate patterns of association in bivariate data		
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 their chores?	**EE.8.SP.4.** Construct a graph or table from given categorical data and compare data categorized in the graph or table.	**Same as above.**

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High School Mathematics: Number and Quantity—The Real Number System		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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 51/3 to be the cube root of 5 because we want (51/3)3 = 5(1/3)3 to hold, so (51/3)3 must equal 5. **N-RN.2**. Rewrite expressions involving radicals and rational exponents using the properties of exponents.	**EE.N-RN.1.** Determine the value of a quantity that is squared or cubed. **Not applicable.**	**Concept:** Number sentences show a relationship and can be written in different ways. **Skills:** Identify the exponent; relate exponent of 2 as squared; relate exponent of 3 as cubed; identify a perfect square; identify a perfect cube; model with tiles a perfect square and a perfect cube; calculate the value of a quantity that is squared or cubed. **Big Idea:** A perfect square is a number that can be expressed as the product of two equal integers. A perfect cube is a number that can be expressed as the product of three equal integers. **Essential Questions:** How can I model this quantity with tiles? What do I do when a number is squared? What do I do when a number is cubed? How can I write this using expanded notation? How do I write this expression using exponents?

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High School Mathematics: Number and Quantity—The Real Number System		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**Not applicable.**	**Not applicable.**

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High School Mathematics: Number and Quantity—Quantities		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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. **N-Q.2.** Define appropriate quantities for the purpose of descriptive modeling. **N-Q.3.** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.	**EE.N-Q.1–3.** Express quantities to the appropriate precision of measurement.	**Concept:** Numerical calculations can be approximated by replacing numbers with other numbers that are close and easy to compute with mentally. **Skills:** Use a calculator to multiply, add, and subtract quantities involving decimals; round the quantity to the nearest tenth or hundredth (e.g., answer 11.825 rounded to 11.82 or $2.97 and $3.51 is about $6.50). **Big Idea:** Precise calculations are not always needed to gain an understanding of the quantity. **Essential Questions:** What does it mean to estimate numerical quantities? How will this number change if I round it to the nearest tenth or nearest hundredth?

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High School Mathematics: Number and Quantity – Complex Number System		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Perform arithmetic operations with complex numbers		
N-CN.1. Know there is a complex number i such that i2 = –1, and every complex number has the form a + bi with a and b real.	**Not applicable.**	**Concept:** Mathematical problems can be solved using different mathematical operation. **Skills:** Solve addition, subtraction, and multiplication problems using the commutative, associative, and distributive properties; solve problems with appropriate operation using whole numbers and decimals; use a model to solve problems. **Big Idea:** The concepts and properties of addition, subtraction, multiplication, and division are the same whether using whole number, fraction, or decimals. **Essential Questions:** What do I know about addition, subtraction, or multiplication that can help me solve this problem? What operation will I use to solve problem? What do I know about the commutative, associative, and distributive properties that can help me solve this problem? How can I represent this problem with a model?
N-CN.2. Use the relation i2 = –1 and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.	**EE.N-CN.2.a.** Use the commutative, associative, and distributive properties to add, subtract, and multiply whole numbers.	
	EE.N-CN.2.b. Solve real-world problems involving addition and subtraction of decimals, using models when needed.	
	EE.N-CN.2.c. Solve real-world problems involving multiplication of decimals and whole numbers, using models when needed.	
N-CN.3. (+) Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers.	**Not applicable.**	

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High School Mathematics: Number and Quantity – Complex Number System		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Represent complex numbers and their operations on the complex plane		
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.	**Not applicable.**	**Not applicable.**
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°.	**Not applicable.**	
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.	**Not applicable.**	

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High School Mathematics: Number and Quantity – Complex Number System		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Use complex numbers in polynomial identities and equations		
N-CN.7. Solve quadratic equations with real coefficients that have complex solutions.	**Not applicable.**	**Not applicable.**
N-CN.8. (+) Extend polynomial identities to the complex numbers. For example, rewrite x2 + 4 as (x + 2i)(x – 2i).	**Not applicable.**	
N-CN.9. (+) Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.	**Not applicable.**	

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High School Mathematics: Number and Quantity – Vector and Matrix Quantities		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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).	**Not applicable.**	**Not applicable.**
N-VM.2. (+) Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point.	**Not applicable.**	
N-VM.3. (+) Solve problems involving velocity and other quantities that can be represented by vectors.	**Not applicable.**	

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High School Mathematics: Number and Quantity – Vector and Matrix Quantities		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Perform operations on vectors		
N-VM.4. (+) Add and subtract vectors.	**Not applicable.**	**Not applicable.**
N-VM.4.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.		
N-VM.4.b. Given two vectors in magnitude and direction form, determine the magnitude and direction of their sum.		
N-VM.4.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.		

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High School Mathematics: Number and Quantity – Vector and Matrix Quantities		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Perform operations on vectors		
N-VM.5. (+) Multiply a vector by a scalar.	**Not applicable.**	**Not applicable.**
N-VM.5.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).		
N-VM.5.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).		

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High School Mathematics: Number and Quantity – Vector and Matrix Quantities		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**Not applicable.**	**Not applicable.**
N-VM.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.		
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.		
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.		
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.		
N-VM.12. (+) Work with 2 × 2 matrices as transformations of the plane, and interpret th absolute value of the determinant in terms of area.		

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High School Mathematics: Algebra—Seeing Structure in Expressions		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Interpret the structure of expressions		
A-SSE.1. Interpret expressions that represent a quantity in terms of its context.*	**EE.A-SSE.1.** Identify an algebraic expression involving one arithmetic operation to represent a real-world problem.	**Concept:** Mathematical problems can be solved using different mathematical operations. **Skills:** Identify an algebraic expression as having a number, an operation, and a variable; interpret a real world problem to identify the operation and the variable; represent real-world problems as expressions (e.g. Susan is twice as tall as Tom; If T = Tom's height, then 2T = Susan's height.). **Big Idea:** Real-world problems can be represented as algebraic expressions. **Essential Questions:** What is the expression for this real-world problem? Which operation and variable can I use to represent this expression?
A-SSE.1.a. Interpret parts of an expression, such as terms, factors, and coefficients.		
A-SSE.1.b. Interpret complicated expressions by viewing one or more of their parts as a single entity. For example, interpret P(1+r)n as the product of P and a factor not depending on P.		
A-SSE.2. Use the structure of an expression to identify ways to rewrite it. For example, see x4 – y4 as (x2)2 – (y2)2, thus recognizing it as a difference of squares that can be factored as (x2 – y2)(x2 + y2).	**Not applicable.**	

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High School Mathematics: Algebra—Seeing Structure in Expressions		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Write expressions in equivalent forms to solve problems		
A-SSE.3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.	**EE.A-SSE.3.** Solve simple algebraic equations with one variable using multiplication and division.	**Concept:** Mathematical problems can be solved using different mathematical operations. **Skills:** Determine the unknown in an equation; use property of inverse operation (multiplication/ division) to complete the inverse to each side of the equation; isolate the variable to solve; solve algebraic expressions using multiplication or division; apply ratio of geometric sequence to determine next term. **Big Idea:** Equations represent equality. Geometric sequences are constant and used to predict values. **Essential Questions:** When I read this equation what quantities are known and unknown? What do I know about multiplication and division that can help me solve this problem? What do I know about equality that can help me solve this problem? What is the next term in the geometric sequence?
A-SSE.3.a. Factor a quadratic expression to reveal the zeros of the function it defines.		
A-SSE.3.b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.		
A-SSE.3.c. Use the properties of exponents to transform expressions for exponential functions. For example the expression 1.15t can be rewritten as (1.151/12)12t ≈ 1.01212t to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.		
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*.	**EE.A-SSE.4.** Determine the successive term in a geometric sequence given the common ratio.	

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High School Mathematics: Algebra—Arithmetic with Polynomials and Rational Expressions		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Perform arithmetic operations on polynomials		
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.	**Not applicable.**	**Not applicable.**
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).	**Not applicable.**	**Not applicable.**
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.		

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High School Mathematics: Algebra—Arithmetic with Polynomials and Rational Expressions		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Use polynomial identities to solve problems		
A-APR.4. Prove polynomial identities, and use them to describe numerical relationships. For example, the polynomial identity (x2 + y2)2 = (x2 – y2)2 + (2xy)2 can be used to generate Pythagorean triples.	**Not applicable.**	**Not applicable.**
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.		

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High School Mathematics: Algebra—Arithmetic with Polynomials and Rational Expressions		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Rewrite rational expressions		
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.	**Not applicable.**	**Not applicable.**
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.		

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High School Mathematics: Algebra—Creating Equations		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**EE.A-CED.1.** Create an equation involving one operation with one variable, and use it to solve a real-world problem.	**Concept:** Rules of arithmetic and algebra can be used together to transform equations and inequalities so real-world problems can be solved. **Skills:** Interpret a problem; determine the unknown in the problem; identify an algebraic expression as having a number, an operation, and a variable; create an equation; use property of inverse operation (addition/subtraction, multiplication/ division) to complete the inverse to each side of the equation; isolate the variable to solve; solve algebraic expressions; compare two expressions using an inequality sign (≠, <, >) (e.g., $x \neq y$, $7 \neq 9$, $x > y$, $13 > 3$, $x < y$, $55 < 365$).
A-CED.2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.	**EE.A-CED.2–4.** Solve one-step inequalities.	

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High School Mathematics: Algebra—Creating Equations		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Create equations that describe numbers or relationships		
A-CED.3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.	**See above.**	**Big Idea:** Techniques for solving equations can be applied to solving inequalities. Inequalities solve for a range of values. **Essential Questions:** What problem do I need to solve? What operation is needed to solve this problem? What equation represents this problem? What numbers make this inequity true? What steps do I follow to solve this equation and/or inequality?
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.		

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High School Mathematics: Algebra – Reasoning with Equations and Inequalities		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**Not applicable.**	**Not applicable.**
A-REI.2. Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.	**Not applicable.** See EE.A-CED.1.	

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High School Mathematics: Algebra – Reasoning with Equations and Inequalities		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**Not applicable.** See EE.A-CED.1.	**Not applicable.**
A-REI.4. Solve quadratic equations in one variable.	**Not applicable.**	
A-REI.4.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.4.b. Solve quadratic equations by inspection (e.g., for x2 = 49), taking square roots, completing the square, th 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 ± bi for real numbers a and b.		

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High School Mathematics: Algebra – Reasoning with Equations and Inequalities		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**Not applicable.**	**Not applicable.**
A-REI.6. Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.	**Not applicable.** See EE.A-REI.10–12.	
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 x2 + y2 = 3.	**Not applicable.** See EE.A-REI.10–12.	
A-REI.8. (+) Represent a system of linear equations as a single matrix equation in a vector variable.	**Not applicable.**	
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 × 3 or greater).	**Not applicable.**	

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High School Mathematics: Algebra – Reasoning with Equations and Inequalities		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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).	**EE.A-REI.10–12.** Interpret the meaning of a point on the graph of a line. For example, on a graph of pizza purchases, trace the graph to a point and tell the number of pizzas purchased and the total cost of the pizzas.	**Concept:** Information can be collected, displayed, summarized and analyzed. **Skills:** Identify value of x-axis; identify value of y-axis; identify where the point is on the coordinate plane; identify the meaning of the point on the graph. **Big Idea:** Points on graphs represent real-world data and can be used to answer questions. **Essential Questions:** What do I know about this graph? What is being compared on this graph? What does the point on this graph tell me?
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.		
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.		

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High School Mathematics: Functions—Interpreting Functions		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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).	**EE.IF.1-3.** Use the concept of function to solve problems.	**Concept:** A function is a mathematical rule that describes how two or more quantities vary in relationship to each other. **Skills:** Identify the relationship between the input and output (the pattern); identify the change (function or rule) for a graph and a table; identify a linear function represented in a graph or table; extend information presented in the tables and graphs to answer questions (if 3 people eat 2 pies and 6 people eat 4 pies, how many pies will 9 people eat?) **Big Idea:** A function can be represented in a table or graph. All forms of a function can be used to extend, predict or infer values to solve problems. **Essential Questions:** How can I use what I know about the problem to help me figure out what I don't know? What question do I need to answer? How do I analyze a function using tables and graphs? What pattern does the graph or table show me? Can I extend the pattern to figure out the answer?
F-IF.2. Use function notation, evaluate functions for inputs in their domains, and interpret statement that use function notation in terms of a context.		
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.		

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High School Mathematics: Functions—Interpreting Functions		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacke**
Interpret functions that arise in applications in terms of the context		
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.*	**EE.F-IF.4–6.** Construct graphs that represent linear functions with different rates of change and interpret which is faster/slower, higher/lower, etc.	**Concept:** Information can be collected, displayed, summarized and analyzed. **Skills:** Use linear function data to create graphs, x-coordinates = input, y-coordinates = output; create a table to record values x and f(x), compare the rate of change (ratio of y/x) between the two functions; explain that the higher value represents a faster or higher change, the lower value represents a slower or lower change; compare the graph to determine which is faster/higher and slower/lower change. **Big Idea:** The graph of a relationship can be analyzed with regard to the change in one quantity relative to the change in the other quantity. **Essential Questions:** How can I represent and describe functions? How do I analyze a function using graphs? How can I determine rates of change by viewing the graph of a function? For each point on the graph, what are the x and y-coordinates? When I compare graphs, how can I tell which one grows at a faster rate of change? When I compare graphs, how can I tell which one has a higher rate of change?
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.*		
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.*		

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High School Mathematics: Functions—Interpreting Functions		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**Not applicable. See EE.F-IF.1–3.**	**Not applicable.**
F-IF.7.a. Graph linear and quadratic functions, and show intercepts, maxima, and minima.		
F-IF.7.b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.		
F-IF.7.c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.		
F-IF.7.d. (+) Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.		
F-IF.7.e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.		

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High School Mathematics: Functions—Interpreting Functions		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Analyze functions using different representations		
F-IF.8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.	**Not applicable.**	**Not applicable.**
F-IF.8.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.8.b. Use the properties of exponents to interpret expressions for exponential functions. For example, identify percent rate of change in functions such as y = (1.02)t, y = (0.97)t, y = (1.01)12t, y = (1.2)t/10, and classify them as representing exponential growth or decay.		
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.	**Not applicable.**	**Not applicable.**

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High School Mathematics: Functions – Building Functions		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Build a function that models a relationship between two quantities		
F-BF.1. Write a function that describes a relationship between two quantities.*	**EE.F-BF.1.** Select the appropriate graphical representation (first quadrant) given a situation involving constant rate of change.	**Concept:** Relationships (functions) can be explored across representations, as each one provides a different view of the same relationship. **Skills:** Identify the graph that demonstrates a given rate of change; identify the recursive rule (e.g., + 3 or -2) for arithmetic sequences; extend the arithmetic sequence by applying the recursive rule (constant rate of change); translate an arithmetic sequence into graphical form. **Big Idea:** Rate of change and a recursive rule can be used to find the next number in a sequence. **Essential Questions:** What is the rate of change? What graph "best" represent the constant rate of change? What strategies can be used to continue a sequence? How can a rule be used to determine unknowns?
F-BF.1.a. Determine an explicit expression, a recursive process, or steps for calculation from a context.		
F-BF.1.b. Combine standard function types using arithmetic operations. For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.		
F-BF.1.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.	**Not Applicable.**	

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High School Mathematics: Functions – Building Functions		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Build a function that models a relationship between two quantities		
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.*	**EE.F-BF.2.** Determine an arithmetic sequence with whole numbers when provided a recursive rule.	
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.	**Not Applicable.**	**Not Applicable.**

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High School Mathematics: Functions – Building Functions		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Build new functions from existing functions		
F-BF.4. Find inverse functions.	**Not applicable.**	**Not applicable.**
F-BF.4.a. 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 x3 or f(x) = (x+1)/(x–1) for x ≠ 1.		
F-BF.4.b. (+) Verify by composition that one function is the inverse of another.		
F-BF.4.c. (+) Read values of an inverse function from a graph or a table, given that the function has an inverse.		
F-BF.4.d. (+) 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.	**Not applicable.**	

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High School Mathematics: Functions—Linear, Quadratic, and Exponential Models		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**EE.F-LE.1–3.** Model a simple linear function such as y = mx to show that these functions increase by equal amounts over equal intervals.	**Concept:** A function is a mathematical rule that describes how two or more quantities vary in relationship to each other. **Skills:** A function is represented in the form of f(x)=x, use the function to create a table of values for x and f(x); determine the constant rate of change between the f(x) values when x values increase is constant; graph the values to determine constant rate of change. **Big Idea:** A function, a graph, and a table are three ways to represent information. **Essential Questions:** What model can I use to determine a constant increase of equal amounts over equal intervals?
F-LE.1.a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.		
F-LE.1.b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.		
F-LE.1.c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.		
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).		

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High School Mathematics: Functions—Linear, Quadratic, and Exponential Models		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Construct and compare linear, quadratic, and exponential models, and solve problems		
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.	**See above.**	
F-LE.4. For exponential models, express as a logarithm the solution to abct = d where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.	**Not applicable.**	
Interpret expressions for functions in terms of the situation they model		
F-LE.5. Interpret the parameters in a linear or exponential function in terms of a context.	**Not applicable.** See EE.F-IF.1–3.	**Not applicable.**

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High School Mathematics: Functions—Trigonometric Functions		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**Not applicable.**	**Not applicable.**
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.		
F-TF.3. (+) Use special triangles to determine geometrically the values of sine, cosine, tangent for π/3, π/4, and π/6, and use the unit circle to express the values of since, cosine, and tangent for π – x, π + x, and 2π – 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.		

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High School Mathematics: Functions—Trigonometric Functions		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Model periodic phenomena with trigonometric functions		
F-TF.5. Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.	**Not applicable.**	**Not applicable.**
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.		
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.		
Prove and apply trigonometric identities		
F-TF.8. Prove the Pythagorean identity sin2(θ) + cos2(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.	**Not applicable.**	**Not applicable.**
F-TF.9. (+) Prove the addition and subtraction formulas for sine, cosine, and tangent, and use them to solve problems.		

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High School Mathematics: Geometry—Congruence		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**EE.G-CO.1.** Know the attributes of perpendicular lines, parallel lines, and line segments; angles; and circles.	**Concept:** Shapes and lines can be described, classified and analyzed by their attributes. **Skills:** Identify points; identify a ray; identify an angle; identify perpendicular lines; identify parallel lines; identify line segments; identify circle; identify a translation (slide), rotation (turning around a point), and reflection (flip) of shapes; describe properties of congruence; identify shapes that are congruent. **Big Idea:** Congruent figures remain congruent through translations, rotations, and reflections. **Essential Questions:** What do I know about shapes and their attributes? How do I know two lines are perpendicular? How do I know lines are parallel? What makes two shapes congruent?
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).	**Not applicable.**	
G-CO.3. Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.	**Not applicable.**	

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High School Mathematics: Geometry—Congruence		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Experiment with transformations in the plane		
G-CO.4. Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.	**EE.G-CO.4–5.** Given a geometric figure and a rotation, reflection, or translation of that figure, identify the components of the two figures that are congruent.	**Same as above.**
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.		

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High School Mathematics: Geometry—Congruence		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**EE.G-CO.6–8.** Identify corresponding congruent and similar parts of shapes.	**Concept: S**hapes can be described, classified and analyzed by their attributes. **Skills:** Compare the lines and angles of shapes; determine if sides (lines) are congruent or proportional; determine if angles are congruent; determine if shapes are similar. **Big Idea:** Shapes can be transformed to similar shapes (larger or smaller) with proportional corresponding sides and congruent corresponding angles. **Essential Questions:** What attributes do I think about to decide if these shapes are congruent? How do I know the sides (lines) are proportional? Which shape is congruent to this shape? Which shape is similar to this shape? What parts of the shape are congruent to this other shape? How do I know the lines are congruent? How do I know the angles are congruent? How would I explain congruent to others?
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-CO.8. Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.		

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High School Mathematics: Geometry—Congruence		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Prove geometric theorems		
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.	**Not applicable.**	**Not applicable.**
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-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 diagonals.		

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High School Mathematics: Geometry—Congruence		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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 line.	**Not applicable.**	**Not applicable.**
G-CO.13. Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.		

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High School Mathematics: Geometry – Similarity, Right Triangles, and Trigonometry		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Understand similarity in terms of similarity transformations		
G-SRT.1. Verify experimentally the properties of dilations given by a center and a scale factor:	**Not applicable.** See EE.G-CO.6–8.	**Not applicable.**
G-SRT.1.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.		
G-SRT.1.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-SRT.3. Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.		

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High School Mathematics: Geometry – Similarity, Right Triangles, and Trigonometry		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**Not applicable.**	**Not applicable.**
G-SRT.5. Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.	**Not applicable.** See EE.G-CO.6–8.	
Define trigonometric ratios, and solve problems involving right triangles		
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	**Not applicable.**	**Not applicable.**
G-SRT.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.		

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High School Mathematics: Geometry – Similarity, Right Triangles, and Trigonometry		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Apply trigonometry to general triangles		
G-SRT.9. (+) Derive the formula A =½ ab sin(C) for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.	**Not applicable.**	**Not applicable.**
G-SRT.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).		

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High School Mathematics: Geometry—Circles		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Understand and apply theorems about circles		
G-C.1. Prove that all circles are similar.	**Not applicable.**	**Not applicable.**
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-C.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 give 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.	**Not applicable.**	**Not applicable.**

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High School Mathematics: Number and Quantity – Expressing Geometric Properties with Equations		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**Not applicable.**	**Not applicable.**
G-GPE.2. Derive the equation of a parabola given a focus and directrix.		
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.		

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High School Mathematics: Number and Quantity – Expressing Geometric Properties with Equations		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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).	**Not applicable.**	**Concept:** Measurement can be applied to solve real world problems. **Skills:** Identify situations that involve calculating area; identify situations that involve calculating perimeter; apply formula to solve a problem; solve word problems to find the area of rectangles by squares, tiling, or formula. **Big Idea:** Perimeter is a linear measurement to calculate the distance around an object. Area is a 2D measurement of how many square units cover the inside of a shape. **Essential Questions:** What is the problem asking me to find? Which formula do I use for perimeter? Which formula do I use for area? What lengths do you know on the square and rectangle? If you don't know the lengths, how can you find them? What is the area and perimeter of the square or rectangle? How does knowing the formula for area and perimeter help me solve problems?
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).	**Not applicable.** See EE.G.CO.1.	
G-GPE.6. Find the point on a directed line segment between two given points that partitions the segment in a given ratio.	**Not applicable.** See EE.G.CO.1.	
G-GPE.7. Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.	**EE.G-GPE.7.** Find perimeters and areas of squares and rectangles to solve real-world problems.	

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High School Mathematics: Geometry—Geometric Measurement and Dimension		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Explain volume formulas, and use them to solve problems		
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.	**EE.G-GMD.1–3.** Make a prediction about the volume of a container, the area of a figure, and the perimeter of a figure, and then test the prediction using formulas or models.	**Concept:** Measurement can be applied to solve real world problems. **Skills:** Make predictions of volume, area and perimeter; test prediction using concrete objects or equations; identify values for what variables represent (l,w,h); solve problems involving area, perimeter and volume using a formula. **Big Idea:** Formulas or models are used to check predictions with area, perimeter, and volume. **Essential Questions:** What information helps me decide if I am finding volume, area, or perimeter? How is finding area different from finding perimeter? What do the variables (l,w,h) represent? What is my prediction about this size of this container/figure? How can I prove my prediction? How did my prediction relate to my calculated value?
G-GMD.2. (+) Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures.	**Not applicable.**	
G-GMD.3. Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.	**Not applicable.** See EE.8.G.9 and EE.G-GPE.7.	

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High School Mathematics: Geometry—Geometric Measurement and Dimension		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**EE.G-GMD.4.** Identify the shapes of two dimensional cross-sections of three-dimensional objects.	**Concept:** Shapes can be seen from various perspectives. **Skills:** Identify attributes of 2 dimensional shapes; identify attributes of 3 dimensional objects; identify what attributes the shapes have in common; identify the shapes within the unfolded 3-D figure (net); cut 2-D cross-sections from 3-D figure. **Big Idea:** Perceiving shapes from different viewpoints helps in understanding the relationships between two-and three-dimensional figures. **Essential Questions:** What 2-D shapes can I make by slicing this 3-D figure in different directions; horizontal, vertical, and diagonal? When I unfold a 3-D figure, what 2-D shapes do I see?

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High School Mathematics: Geometry—Modeling and Geometry		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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).	**EE.G-MG.1–3.** Use properties of geometric shapes to describe real-life objects.	**Concept:** Shapes can be defined and classified by their attributes. **Skills:** Identify common attributes between 2 dimensional shapes and 3 dimensional figures; recognize common 2 dimensional shapes and 3 dimensional figures; make comparisons between common 2-D shapes and 3-D figures to real-life objects; describe real life objects using attributes of 2-D shapes and 3-D figures; name everyday objects in terms of geometric shapes. **Big Idea:** Geometric properties help us determine and define shapes in the real world. **Essential Questions:** How can I describe this object? What common attributes does this object have with either a 2-D shape or 3-D figure?
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-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).		

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High School Mathematics: Statistics and Probability«—Interpreting Categorical and Quantitative Data		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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).	**EE.S-ID.1–2.** Given data, construct a simple graph (line, pie, bar, or picture) or table, and interpret the data.	**Concept:** Information can be collected, displayed, summarized and analyzed. **Skills:** Represent data on a variety of graphs (line, pie, bar, or picture); represent data on a table; interpret the graph or table to answer a question; identify the trends on a graph or chart; interpret the meaning of the trend on a graph or chart; calculate the mean of a data set. **Big Idea:** The mean is a measure of the average and can be used to summarize the data set. **Essential Questions:** How can I calculate the mean of this given set? What does the mean tell me? How can this data be displayed in a graph? What trends are represented in the graph?
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.		
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).	**EE.S-ID.3.** Interpret general trends on a graph or chart.	
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.	**EE.S-ID.4.** Calculate the mean of a given data set (limit the number of data points to fewer than five).	

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High School Mathematics: Geometry—Geometric Measurement and Dimension		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**Not applicable.** See EE.F-IF.1 and EE.A-REI.6–7.	**Not applicable.**
S-ID.6. Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.	**Not applicable.**	
S-ID.6.a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions, or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.		
S-ID.6.b. Informally assess the fit of a function by plotting and analyzing residuals.		
S-ID.6.c. Fit a linear function for a scatter plot that suggests a linear association.		

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High School Mathematics: Geometry—Geometric Measurement and Dimension		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**Not applicable.** See EE.F-IF.4–6.	**Not applicable.**
S-ID.8. Compute (using technology), and interpret the correlation coefficient of a linear fit.	**Not applicable.**	
S-ID.9. Distinguish between correlation and causation.		

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High School Mathematics: Statistics and Probability—Making Inferences and Justifying Conclusions		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**EE.S-IC.1–2.** Determine the likelihood of an event occurring when the outcomes are equally likely to occur.	**Concept:** Probability is used to make informed decisions. **Skills:** When given a situation of equal probabilities (e.g., pick 1 cube from a bag containing 1 red, 1 blue, and 1 green cube), identify the correct probability (e.g., the probability of drawing a green cube is 1/3) . **Big Idea:** Events that have the same chance of occurring will have equal probability. **Essential Questions:** What does it mean for something to be more or less likely? What does it mean for something to be equally likely? What are the number of ways an event can occur and the total possible outcomes?
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 questio the model?		

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High School Mathematics: Statistics and Probability—Making Inferences and Justifying Conclusions		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**Not applicable.** See EE.S-ID.1–2.	**Not applicable.**
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.		
S-IC.5. Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.		
S-IC.6. Evaluate reports based on data.		

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High School Mathematics: Statistics and Probability—Making Inferences and Justifying Conclusions		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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").	**EE.S-CP.1–5**. Identify when events are independent or dependent.	**Concept:** Probability is the extent to which an event is likely to occur. **Skills:** Identify the number of ways an event can occur and the total possible outcomes (e.g., there are 3 red marbles in a bag and 2 green marbles, what is the probability of pulling out a red marble? 3/5); identify when two events are independent; identify when two events are dependent. **Big Idea:** Independent and dependent events change the probability outcome. **Essential Questions:** What is the event the question focuses on? What are the possible outcomes for this event? How can I determine if a situation involves dependent or independent events?
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.		
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.		

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High School Mathematics: Statistics and Probability—Making Inferences and Justifying Conclusions		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Understand independence and conditional probability, and use them to interpret data		
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.	**See above.**	
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.		

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High School Mathematics: Statistics and Probability—Making Inferences and Justifying Conclusions		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**Not applicable.** See EE.S-IC.1–2.	**Not applicable.**
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.		
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.	**Not applicable.**	
S-CP.9. (+) Use permutations and combinations to compute probabilities of compound events and solve problems.		

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High School Mathematics: Statistics and Probability—Using Probability to Make Decisions		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**Not applicable.**	**Not applicable.**
S-MD.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.		

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High School Mathematics: Statistics and Probability—Using Probability to Make Decisions		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
Calculate expected values, and use them to solve problems		
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?	**Not applicable.**	**Not applicable.**

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High School Mathematics: Statistics and Probability—Using Probability to Make Decisions		
Iowa Core Grade-Level Standards	**Iowa Core Essential Element**	**Unpacked**
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.	**Not applicable.**	**Not applicable.**
S-MD.5.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.		
S-MD.5.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.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).		

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