In-Progress…

About 75% of the correlations are done. The yet-to-correlate:

- Fractions (all yet to be done)
- Measurement and Data (some are correlated)
- Geometry (all yet to be done)

We'll send you the completed document in the next few weeks. Thanks for your patience!

Grade 4

The Private Eye® aligned with Common Core State Standards for Mathematical Practice and Content

Welcome!

The Private Eye makes math a language to love, even as it helps build a mathematical vocabulary. It turns math into something personal, intriguing, friendly, alive. The Private Eye's hands-on, interdisciplinary process and instructional strategy braids together three languages: verbal, visual, and mathematical.

The Private Eye begins with four simple questions, everyday objects, and a jeweler's loupe (an almost magical magnification tool). Using The Private Eye process students enhance concentration, heighten their awareness of pattern and detail, and learn to evoke analogic thinking for problem-solving. TPE delivers students directly to the "land of Math" — the science of patterns and relationships. Whenever you use The Private Eye, pattern is "in your face"—you're massaging the math brain, even as you massage the scientist's, writer's, artist's brain.

The Private Eye blends with your existing math course-of-study to develop habits of mind essential to mathematical practice. As you consider your math year, you'll find you can use TPE in your classroom to: introduce, enhance, cement and assess mathematical concepts and content. It helps students settle down and focus as preparation for a new or existing mathematical concept. It calms their fears that a math topic will be too difficult, too foreign. It grounds concepts in a student's personal knowledge and associations and in the five senses. It generates mathematical inquiries that live and breathe.

With its simple tools, rich questioning strategy, and everyday objects, students can write, draw, theorize, count, measure, compute, calculate, estimate, predict and perform mathematical operations. In the process they build four underlying *and interwoven habits of mind* critical to academic success: looking closely, thinking by analogy, changing scale, and theorizing. These are the intellectual "tools" not only for mathematical literacy, but for creativity, literacy, and scientific literacy as well. The book, *The Private Eye —(5X) Looking/Thinking by Analogy: A Guide to Developing the Interdisciplinary Mind,* shows how to fluently develop these essential habits. A special Math Tour of lesson connections begins on page 173.

*   *   *

This document correlates *The Private Eye—(5X) Looking/Thinking by Analogy* to the mathematical practices and content outlined in the Common Core State Standards for Grade 3. Along the way, the document provides many "how to" examples for meeting and practicing the content of each standard in the context of Private Eye use. (For Private Eye CCSS Literacy correlations, please see our separate publication.)

Common Core State Standards for Mathematics: GRADE 4

THE PRIVATE EYE® — (5X) LOOKING / THINKING BY ANALOGY® Correlation

Standards for Mathematical Practice	*THE PRIVATE EYE® — (5X) LOOKING / THINKING BY ANALOGY®* *A Guide to Developing the Interdisciplinary Mind*

Meet all eight CCSS Standards for Mathematical Practice using The Private Eye (TPE) in Math *and* across your curriculum day:

1. Make sense of problems and persevere in solving them. Thinking by Analogy (making associations and using them for theorizing, inferring, modeling) is how we make sense of the world. The Private Eye boosts analogic reasoning as it also builds concentration, ever-increasing attention to detail, and wonder at the world's patterns and relationships. Using TPE builds perseverance incrementally and naturally. The Private Eye's exploratory inquiry generates options to approach problem solving. It builds *problem-solving by analogy* using verbal, visual, and mathematical languages.

2. Reason abstractly and quantitatively.
Analogic reasoning is the abstract reasoning at the heart of mathematical reasoning. TPE process is rooted in analogic reasoning: proportional reasoning, making inferences, theorizing — based on strategic use of associations. (BTW, the term "analogy" was originally a math term!)

"Analogy is the Interstate Freeway of Cognition", notes Douglas Hofstadter. We use analogy in forms verbal, visual, and numerical — creating and using analogs, comparisons, and models — to understand and solve problems. TPE tools and strategy evoke and constantly build analogic / comparative thinking for students and adults. Hands-on explorations quicken abstract reasoning while keeping students grounded in real world applications. Repetition with TPE process makes analogic reasoning in verbal, visual and mathematical languages into a habit for students, an instinctive practice.

3. Construct viable arguments and critique the reasoning of others. TPE's inquiry approach includes: "Why is it like that?" "What's going on here?" TPE gives students a hypothesizing and theorizing strategy to answer these questions using words, numbers, images to generate models. Students work individually and collaboratively, examining and critiquing each other's methods and conclusions.

4. Model with mathematics.
Models are essentially analogies: an exploration and a representation of patterns, structures, behaviors, and relationships we discover in the world around us. Numbers are analogs that explore and represent specific quantities, interactions, operations, measurements, behaviors, and relationships. TPE helps students practice moving between modeling with mathematical analogs and modeling with verbal, visual, and structural analogs.

5. Use appropriate tools strategically.
The Private Eye Tools: a 5X Loupe (a marvelous magnification tool), everyday objects (manipulatives), loupe-drawing, and loupe-analogy observations are all mathematical tools in the context of math explorations. (TPE Questions are tools, as well!) The loupe allows students to change scale — to find mathematical numbers, shapes, concepts and relationships in small places in comparison with large scale situations. The loupe enlarges objects or parts of objects by 5X (10X if two loupes nested) creating a heightened interest in structures, patterns and measurements. It boosts Mathematical Practices #6, 7, and 8.

6. Attend to precision.
The Private Eye's loupe and questioning strategy gives students a jolt of attention to detail: it literally "teaches" what attention to detail and precision *means*. Using TPE students explore real world shapes, structures and relationships in conjunction with analogic observations — verbal, visual, mathematical — to express ever more precise communication / thinking. TPE hones ability to discern and distinguish less obvious similarities and differences.

7. Look for and make use of structure.
TPE loupes and Questions help students habitually look closely for structures, patterns and relationships at changes of scale, small and large. In a math context, this habit of mind translates into a heightened sensitivity to numerical structures and sequences.

8. Look for and express regularity in repeated reasoning. Thinking by Analogy fueled with Looking Closely is fundamental to pattern recognition. Using TPE in math — a repeating loop of questions for investigating and reasoning — sensitizes students to looking for regularity in mathematical structures.

When you use The Private Eye's interdisciplinary process in math, you not only meet math standards correlated to the lesson, but specific Science and Literacy Standards as well. See CCSS Literacy / TPE correlations.

Standards for Mathematical Content	***THE PRIVATE EYE® — (5X) LOOKING / THINKING BY ANALOGY®*** *A Guide to Developing the Interdisciplinary Mind*
GRADE 4	***Prep:*** *Read "Process and Tools", pp. 11-31; and "Math Tour", pp.175-194. Introduce students to The Private Eye (TPE) loupe & process: looking closely, thinking by analogy, changing scale, and theorizing. TPE's holistic math activities connect to multiple standards and can be adapted for any grade. (Along the way, it's easy and fun to create your own lessons.)* ***Practice:*** *In the correlations we provide some "unpacking" of standards, grade-level examples, and a starter list of TPE book connections. On some days, you may choose merely to use the loupe with everyday objects for knock-your-socks-off, content-rich manipulatives to meet detailed elements of a standard. But connect these experiences to a Private Eye-listed activity — even better, to the full, interdisciplinary Private Eye process (TPE Questions / loupe-drawing / writing / science content / theorizing) — and you'll see a real difference in how students think and communicate mathematically. Students will rev up creative and critical thinking in tandem with math skills. They'll fall in love with math.*
Operations and Algebraic Thinking 4.OA	
Use the four operations with whole numbers to solve problems. **4.OA.1** 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.	**Use the four operations with whole numbers to solve problems.** **Overview:** As students loupe-examine, draw, and manipulate everyday objects (objects with multiple parts or sets of objects — beans, seeds, pennies, popcorn kernels, leaves, small twigs, etc.) **they'll investigate the four operations (multiplication, division, addition, subtraction) to solve problems.** They'll build on previous understanding of numbers used to represent individual items, groups of items, and numbers of groups. They can verbally interpret the meaning of the numbers in a multiplication problem, and can see how multiplication relates to division. **Students use Private Eye contexts to help them understand and explain:** that multiplication is actually repeated addition; that one number in a multiplication problem represents the "multiplicand", the number of objects in each group (set), and the other number is the "multiplier", the number of times a group (set) is repeated. Students move into solving problems using the four operations and creating them for their peers to solve. They become fluent in abstract thinking when grounded in concrete realities and models. 1. Students use Private Eye contexts to **interpret a multiplication equation as a comparison**. (NOTE: a verbal comparison is an analogy/metaphor/simile. One thing is "like" another, i.e., shares one or more characteristics with what it is being compared.) In this standard the language of mathematical "comparisons" is explored. 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. Students represent verbal statements of multiplicative comparisons as multiplication equations. They should be able to say which quantity is being multiplied and which number tells how many times. **Example: Popcorn Multiplication**. After loupe-studying one piece of popcorn and using TPE first questions for bonding with the subject, students receive 35 pieces of popcorn each. Teacher instructs: How many pieces total do you have? Now, arrange your popcorn pieces into 5 groups of 7 pieces each. After discussing interpretations (continued next page…)

Represent and solve problems involving multiplication and division (continued)	Represent and solve problems involving multiplication and division. (continued)
4.OA.1 (continued)	**Example** (continued from previous page) of what each student has created, teach the language of "comparison": that "35 is 5 times as many as 7" — and have students represent it by writing 35 = 5 x 7 in their Math Journals, perhaps entitled Popcorn Multiplication. They also write an explanation of the equation, its *meaning*. They then rearrange popcorn to make 7 groups of 5 pieces each: 35 = 7 x 5. Thus they investigate how a total number — in this case, "35" (pieces of popcorn) — represents the "product" of an interaction between two other whole numbers and that a multiplication equation is a comparison in which a product can be expressed, often in more than one way, in this case as: "5 x 7" or "7 x 5". Practice representing other multiplication problems with other objects (small and large) in multiples. Students write the multiplication equations. The teacher also creates reverse situations to make sure students understand: create equations which students must represent with their objects (in various groupings) and practice expressing/writing down a context in which the equation would be true. E.g., 5 X 4 = 20. One possible context: Maria has 5 times as many pieces of popcorn as Sarah. If Maria has 20 pieces of popcorn, how many pieces of popcorn does Sarah have? 20 = 5 X ?. Sarah has 4 pieces of popcorn: 20 = 5 X 4. Students can create these models of comparison on their desks with physical objects. Again, students describe their thinking and extend it to other objects / contexts.  • Math Plans & Ticklers: Sequence, p. 175 • Seeds! p.180 • Foxglove Towers, p. 180 • Seed Pods Pop p. 145 • Seed Collections, p. 144 • Traveling a Mathematical Loupe: 2) Scale and Proportion, p. 175 3) Area and Perimeter, p. 176

4.OA.2

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.

2. Students **multiply or divide to solve word problems involving multiplicative comparison**, again using loupe-study objects to manipulate for initial models to insure understanding (assisted by having personally bonded with an object of loupe-inquiry and by the kinethestics of moving and grouping objects). The teacher models how to create word problems involving multiplicative comparisons related to loupe-study objects and how to represent the problem by creating equations with a symbol for the unknown number. Students begin by creating these models of comparison on their desks with physical objects, then create the word problems to express them. Again, students describe their thinking and extend it to other objects / contexts. Students demonstrate that they can distinguish multiplicative comparison from additive comparison. Students solve teacher-generated problems, then create such word problems for each other to solve.

Examples: After students have been loupe-analogy studying popcorn…

Unknown Product: A bag of regular popcorn costs $2. A big bag of cany popcorn costs 3X as much. How much does candy popcorn cost? $2 x 3 = p

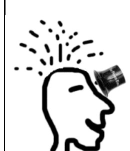
Group Size Unknown: Maria has 20 pieces of popcorn. She has 5 times as many pieces of popcorn as Sarah. How many pieces of popcorn does Sarah have? 5 X p = 20 Or: 20 ÷ 5 = n

Number of Groups Unknown: A jumbo bucket of movie popcorn costs $12. A candy bar costs $3. How many times as much does the popcorn cost compared to the candy?
$12 ÷ 3 = p or 3 x p = $12

Make sure students understand the difference between multiplicative comparison and additive comparison. Examples of Additive Comparison:

1) If Maria has 5 *more* pieces of popcorn than Sarah, and Sarah has 15 pieces in all, how many pieces of popcorn does Maria have? Express this as an equation: 15 + 5 = p

2) Sarah and Maria have combined their pieces of popcorn into one bowl. The bowl has 50 pieces. Sarah contributed 40 pieces. How many more pieces of popcorn did Maria contribute? 40 + p = 50



- Math Plans & Ticklers: Sequence, p. 175
- Seeds! p.180
- Foxglove Towers, p. 180
- Seed Pods Pop p. 145
- Seed Collections, p. 144
- Traveling a Mathematical Loupe:
  2) Scale and Proportion, p. 175
  3) Area and Perimeter, p. 176

4.OA.3

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.

3. Students link explorations of loupe-study objects to **solving multi-step word problems posed with whole numbers and having whole-number answers using the four operations** — including problems in which remainders must be interpreted. (Ideally the objects of loupe-study relate to content area investigations in science, literacy, social studies, and/or art.) Students represent the mulitstep word problems using equations with a letter, e.g., *n* or *x*, that stands for the unknown quantity. The teacher models how to create the problems at first, then give students a ***Private Eye Peer Math Challenge***.

Private Eye Peer Math Challenge: In two-person teams, students a) create (and write down) 5 multi-step word problems using the four operations for peers to solve — problems relating to a Private Eye loupe-study investigation. b) They also represent each problem's solution using an equation with a letter standing for the unknown quantity — a solution to the problem which they don't share with whatever team is solving their problems. c) When teams exchange problems, they represent these problems using equations with a letter standing for the unknown quantity. d) They assess the reasonableness of answers using mental computation and estimation strategies including rounding. e) They share with the larger group a favorite problem they created and its solution equation. f) Peers also critique problems for what's missing, what went wrong and what went right.

As part of the process, students assess the reasonableness of answers using **mental computation** and **estimation strategies** including rounding.

Examples / Sample Context: Students have studied seeds, e.g., sunflower or pumpkin seeds, their life cycle, ecology, how and where they grow, who eats them in the wild, how they are used in human commerce, etc.   Perhaps students have eaten some seeds, researched the nutrition factor, and even planted them in a windowsill or school garden, charting seed/plant growth. Both teacher and students create and solve related math problems.

Multi-step word problem 1) In the school garden we planted sunflower seeds. On day 1 we planted 123 seeds. On day 2: 39 seeds. On day 3: 297 seeds. Using rounding strategies to the nearest group of ten or hundred, estimate how many seeds we planted.
Example equation to represent solution: 100 + 40 + 300 = x seeds

Multi-step word problem 2) The goal is for the class to plant 600 sunflower seeds around the school. Mary will buy 5 packs of 31 seeds each. Sam will buy 3 packs with 48 seeds. How many more seeds do we need to buy?

5 X 30 (rounded down from 31) = x (est.150)   3 X 50 (if rounded up from 48) = n (est.150)

600 – 300 = y   We estimate we need about 300 more seeds.

(continued next page…)

4.OA.3

3. **Solve multistep word problems posed with whole numbers** and **having whole-number answers using the four operations** (continued)

3. **Solve multistep word problems posed with whole numbers** and **having whole-number answers using the four operations** (continued)

Multi-step word problem 3) The students need to bag pumpkin seeds they collected from the school garden last year. They collected 128 seeds. If each small bag can hold 10 seeds, how many bags are needed? 128 ÷ 10 = b b = 12 with a remainder of 10 seeds. Rounded up, 13 bags are needed.

- Math Plans & Ticklers: Sequence, p. 175
- The Ultimate Portrait p. 177 – 178
- 36 Portraits with Statistics, p. 178
- A Game Like: “How Many Marbles in This Jar?”, p. 180 (Use for any flower seedpod!)
- Seeds! p. 180 (but skip the 50X microscope if you don’t have one — and use for any flower seedpod!)
- Map a Strawberry and Count / estimate sword fern spores (two more great objects of study)
- The Four Foot Dandelion, p. 179

Gain familiarity with factors and multiples.

4.OA.4

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.

Gain familiarity with factors and multiples.

Gain familiarity with factors and multiples.

4.OA.5

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.*

Gain familiarity with factors and multiples.

Numbers and Operations in Base Ten 4.NBT	
Generalize place value understanding for multi-digit whole numbers. **4.NBT.1** 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.*	**Generalize place value understanding for multi-digit whole numbers.**
4.NBT.2 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.	2. In this standard students learn various ways to read and write numbers between 1,000 and 1,000,000. You'll teach them the role of commas, how each sequence of digits is read as hundreds, tens and ones followed by the applicable base-thousand unit (thousand, million, billion, trillion, and so on). Hence, 378,000 is read "three hundred seventy eight thousand". Because of the uniformity of base-ten system, students apply the same methods for comparing and rounding numbers that they learned in earlier grades. After students gain a foothold understanding of how to write and read numbers 1,000 up to 1,000,000, it's a great time for them to practice writing and reading their new BIG numbers related to loupe-study objects from the natural or manmade world (which will heighten motivation). You'll have the opportunity to broaden Private Eye-based inquiries. You'll also have the opportunity to help students visualize huge numbers of something, including what a million of something can look like. This prevents numbers from beginning to float off into a disconnected universe. **Example:** Let's say you've been studing trees and their leaves, along with photosynthesis. Weaving The Private Eye into classroom work, students have loupe-studied a leaf, created loupe-analogy lists, written a short essay pulling from their analogy lists, completed a close-up drawing, perhaps a big artistic leaf with color. Putting on a "math hat" you now might say: "To go with our Tree Leaf studies, we'll do some Leaf and Tree Math. Let's head into some big tree numbers that will give us a chance to practice reading and writing really BIG numbers we've been learning about. Today's tree math begins with the following problem:" A medium size tree is planted on a block of the city. On one tree branch of one tree (e.g., maple) there are 165 big leaves photosynthesizing and giving off lovely fresh oxygen for us to breathe. There are 18 branches on the tree with about that many big leaves. How many leaves are on the one tree? (Instead of having students do the multiplication, the teacher can just write the answer on a whiteboard — since the point of this standard is reading and writing numbers. On the board you write: 2,970). "So who'll read this number for us? After a student successfully reads the number: "Now I want everyone to write that number out in words in your math journal: 'two thousand nine hundred seventy.' But there are more trees on that block. There are ten trees. So how many leaves are at work photosynthesizing on that one block? I'll write the number down. (29,700) Who'll read it? 'Twenty nine thousand seven hundred.' That makes a lot of busy leaves. (continued next page…)

Generalize place value understanding for multi-digit whole numbers. (continued)

2. (continued) 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.

Generalize place value understanding for multi-digit whole numbers. (continued)

But wait! The city planted 20 blocks of the downtown area with these trees. So now how many leaves are all singing their photosynthesis song all at once? 20 X 29,000 = 580,000. (Again write the number on the board and again ask a student to read it aloud.) Students again write that number in its numerical form and its word form: five hundred eighty thousand leaves.

Examples:

"How many more leaves would it take to reach a million leaves?" (420,000 more leaves)

Revisit each stage of the problem (or similar problems) with students rounding off the numbers.

Revisit the stages of the problem above but use numbers representing smaller and larger trees.

- Math Plans & Ticklers: Sequence, p. 175
- Leaf Math to Tree Math, p. 182
- In a Blade of Grass, p. 169 (To get another sense of big numbers, including a million… After loupe-studying architecture of grass blade, and after estimating how many blades of grass grow in a square foot: how many square feet of lawn at that density of grass blades will result in a million blades of grass?)

4.NBT.3

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

3. Students link loupe-study objects to the place value understanding to round multi-digit numbers to any place.

Example: The class is collecting leaves for a fall photosynthesis mural. The total needed is 500 leaves.

Bob and Jose bring in 18 leaves each. Sara and Jenn bring in 44 leaves each. About how many more leaves does the class need to collect?

2 (boys) x 18 – 36 which is about 40.v

2 (girls) x 44 = 88 which is about 100.

40 + 100 = 140. We need 500 leaves so:

500 – 140 = 360. We need about 360 more leaves.

- Math Plans & Ticklers: Sequence, p. 175
- Leaf Math to Tree Math, p. 182
- In a Blade of Grass, p. 169

Use place value understanding and properties of operations to perform multi-digit arithmetic. **4.NBT.4** 4. Fluently add and subtract multi-digit whole numbers using the standard algorithm	**Use place value understanding and properties of operations to perform multi-digit arithmetic.**
4.NBT.5 5. Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.	
4.NBT.6 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.	

Number and Operations—Fractions 4.NF	
Extend understanding of fraction equivalence and ordering. **4.NF.1** 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. **4.NF.2** 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.	**Extend understanding of fraction equivalence and ordering.** **In Progress… Coming soon**

Build fractions from unit fractions by applying and extending previous understandings of operations on whole numbers.

4.NF.3

3. Understand a fraction *a/b* with *a* > 1 as a sum of fractions 1/b..

   a. Understand addition and subtraction of fractions as joining and separating parts referring to the same whole.

   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.*

   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.

   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.

4.NF.4

4. Apply and extend previous understandings of multiplication to multiply a fraction by a whole number.

   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).*

   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.)*

   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?*

Build fractions from unit fractions by applying and extending previous understandings of operations on whole numbers.

In Progress… Coming soon

Understand decimal notation for fractions, and compare decimal fractions.

4.NF.5

5. Express a fraction with denominator 10 as an equivalent fraction with denominator 100, and use this technique to add two fractions with respective denominators 10 and 100.[4] *For example, express 3/10 as 30/100, and add 3/10 + 4/100 = 34/100.*

4.NF.6

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

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.

Understand decimal notation for fractions, and compare decimal fractions.

In Progress… Coming soon

Measurement and Data **4.MD**	

Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit.

4.MD.1

1. Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two- column table. *For example, know that 1 ft is 12 times as long as 1 in. Express the length of a 4 ft snake as 48 in. Generate a conversion table for feet and inches listing the number pairs (1, 12), (2, 24), (3, 36), ...*

4.MD.2

2. Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale.

4.MD.3

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*

Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit.

After students learn the basics of this standard they can practice applying it in simple word problems and in simple practical applications using loupe-study objects. Basics: First students learn the relative sizes of measurement units within one system, including: km, m, cm; in, ft, yd; kg, g; lb, oz.; l, ml; hr, min, sec. and, Within a single system of measurement, they demonstrate that they can express measurements in a larger unit in terms of a smaller unit (e.g., 1 foot is 12 times as long as 1 inch.). Students have created a 2 column table to record measurement equivalents. Using the 2-column conversion table they've generated for km, m, cm; in, ft, yd; kg, g; lb, oz.   students now relate their new knowledge to controlled loupe-study objects easy to control in length or weight. loupe-study objects egs: lengths of rope, ribbon, twine, string cut in various increments of 1 – 4 foot lengths. — their structures are interesting under a loupe. How about weight? Anything controllable? Sure, a lb/16oz of potatoes/carrots …A kg/g of fruits/veg… Within a single system of measurement, students will express measurements in a larger unit in terms of a smaller unit. Students will create a 2 column table to record measurement equivalents. The teacher can create a first set of problems / conversion challenges for students to solve. Then have student teams create problems based on actually measuring various loupe-study objects (which can be small individual objects, objects lined up to create a longer length, or objects that are large to begin with but are interesting to study under a loupe. conversion measurement problems for fellow teams to solve.

Example: Take one loupe-study object (e.g., a magnolia pod, a snake shed, a bag of potatoes, a batch of leaves, a set of night lightbulbs, a kitchen sponge, etc.) and see how many ways you can measure it — in how many systems.. and express each measurement in both a larger unit and in terms of a smaller unit. Can you measure its length and girth? Do it in km, m, cm, also in in, ft, yd. What about 10 of the objects lined up? Can you measure the same object's weight kg and g? What about 10 quantity of the object?

Example: If the snake shed is 3 feet long, how many inches long is it?
If I cut off 1 foot, how many inches remain?

Example: If I take 180 seconds to make a "loupe-list", how many minutes did I take?

2?   Example: (OK to have random sized objects? Too difficult for 4th grade?) Take one loupe-study object (e.g., a magnolia pod, a snake shed, a bag of potatoes, a batch of leaves, a set of night lightbulbs, a kitchen sponge, etc.) and see how many ways you can measure it — in how many systems.. and express each measurement in both a larger unit and in terms of a smaller unit. Can you measure its length and girth? Do it in km, m, cm, also in in, ft, yd. What about 10 of the objects lined up? Can you measure the same object's weight kg and g? What about 10 quantity of the object?

Represent and interpret data. **4.MD.4**	**Represent and interpret data.**
Geometric measurement: understand concepts of angle and measure angles. **4.MD.5** 5. Recognize angles as geometric shapes that are formed wherever two rays share a common endpoint, and understand concepts of angle measurement: 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. b. An angle that turns through *n* one-degree angles is said to have an angle measure of *n* degrees. **4.MD.6** 6. **Measure areas by counting unit squares** (square cm, square m, square in, square ft, and improvised units). **4.MD.7** 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.	**Geometric measurement: understand concepts of angle and measure angles.** **In Progress… Coming soon**

Geometry 4.G	
Draw and identify lines and angles, and classify shapes by properties of their lines and angles. **4.G.1** 1. Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures. **4.G.2** 2. Classify two-dimensional figures based on the presence or absence of parallel or perpendicular lines, or the presence or absence of angles of a specified size. Recognize right triangles as a category, and identify right triangles. . **4.G.3** 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.	**Draw and identify lines and angles, and classify shapes by properties of their lines and angles.** **In Progress… Coming soon**