Grade 1

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.

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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 1

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.

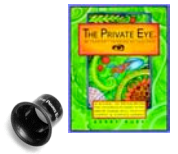
7. Look for and make use of structure.
TPE loupes and Questions help students habitually look closely for structures, patterns and relationships at changes of scale, small and large. In a math context, this habit of mind translates into a heightened sensitivity to numerical structures and sequences.

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.

Common Core State Standards for Mathematics: GRADE 1

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



Standards for Mathematical Content	***THE PRIVATE EYE® — (5X) LOOKING / THINKING BY ANALOGY®*** *— A Guide to Developing the Interdisciplinary Mind —*
GRADE 1	***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 1.OA	
Represent and solve problems involving addition and subtraction. **1.OA.1** 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.	**Represent and solve problems involving addition and subtraction.** **Overview:** For real world math investigations, concept development, and practice in mathematical operations, provide students with sets of loupe-study objects (beans, pennies, popcorn, rocks, shells, flowers, small twigs, pumpkin seeds, sunflower seeds, cotton balls, a slice of bread cut into small pieces, etc.). You can also use objects with multiple parts (e.g., a flower has petals; a branch has leaves; a ladybug has spots, legs, antennae; and so on). Have students loupe-explore the object first and create a loupe-analogy list to create personal bonds. When students loupe draw the object, they develop pattern sensitivity, kinesthetic and spatial awareness. Before or after the math lesson, link each object to an investigation that broadens into art, writing, reading, science, and/or social studies. 1. Students **use loupe-study objects as the basis of addition and subtraction word problems (within 20) that involve adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions.** After students have loupe-explored and bonded with an object, the teacher generates word problems for students to solve based on the objects. Then students suggest word problems for peers to solve. **Use objects, drawings, and equations with a symbol for the unknown number to represent the problem.** Students write down the math symbols representing the problems, the unknown number, and solutions. **Examples:** If you have 2 pennies and find 10 more pennies, how many do you have in all? 2 + 10 = ☐ 2 + 10 = 12 If you take away 5 beans from a pile of 20 beans, how many are left? 20 – 5 = ☒ 20 – 5 = 15 … Continued next page

Represent and solve problems involving addition and subtraction. … continued

1.OA.1 … continued

1.OA.2

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.

Continued from previous page

- Math Plans & Ticklers: *Sequence*, p. 175
- Seeds! p.180 — combined with Math Plans & Ticklers: *Sequence*, p. 175 (skip microscope)

Example: Students loupe-observe seeds from seed packets. They practice solving addition and subtraction problems the teacher creates. Students then create word problems for a peer to solve. With a teacher's help they create equations with a symbol for the unknown number to represent the problem.

Example: Loupe-observe cut sections of fruits / vegetables to view seeds. Students practice adding / subtracting seeds from cut sections of apples, oranges, snap peas, etc. Students then create word problems for a peer to solve. With a teacher's help they create equations with a symbol for the unknown number to represent the problem.

2. Students **use loupe-study objects as a springboard for solving word problems in which three whole numbers must be added —** whose sum is less than or equal to 20. The teacher creates word problems at first, then students generate word problems for peers to solve. **The teacher demonstrates how to write equations with a symbol for the unknown number to represent the problem. Students practice writing such equations.**

Example:
If you collect 6 shells from a beach, your friend gives you 4 shells,
and your mother adds 8 more shells to your collection,
how many shells do you have in all?

6 + 4 + 8 = ☐ 6+ 4 + 8 = 18 shells

- Math Plans & Ticklers: Sequence, p. 175
- Seeds! p.180 — combined with Math Plans & Ticklers: *Sequence*, p. 175 (skip microscope)

Example: Students loupe-observe seeds from seed packets — then practice solving word problems the teacher creates that call for the addition of three whole numbers whose sum is less than or equal to 20. Students also create word problems for a peer to solve. With a teacher's help, students create equations with a symbol for the unknown number to represent the problem.

Example: Do the same (as above) with cut sections of fruits / vegetables to view seeds. (E.g., apples, oranges, snap peas, etc.)

Common Core State Standards for Mathematics: GRADE 1

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

Understand and apply properties of operations and the relationship between addition and subtraction.	**Understand and apply properties of operations and the relationship between addition and subtraction.**
1.OA.3 3. Apply properties of operations as strategies to add and subtract. Examples: If 8 + 3 = 11 is known, then 3 + 8 = 11 is also known. (Commutative property of addition.) To add 2 + 6 + 4, the second two numbers can be added to make a ten, so 2 + 6 + 4 = 2 + 10 = 12. (Associative property of addition.)	**Overview:** To demonstrate properties of operations as strategies for understanding how addition and subtraction relate, students continue to work with sets of loupe-study objects (e.g., a set of beans) as "counters". Or use objects with multiple parts (flower with petals; branches with leaves). The teacher leads students in observing, counting, arranging and re-arranging objects — or parts of objects. As often as possible, link to a broader science, art, and writing/reading activities with The Private Eye. **3. Students apply properties of operations as strategies to add** (properties of operations for subtraction come at higher grades) using loupe-study objects to ground the concepts in concrete reality. **Examples:** **Commutative property of addition:** If my partner and I each have a flower, and we want to know the total number of petals between us, we can count the petals on each flower and add them up. If we start by counting my flower and it has 4 petals and I lay the flower on the desk and than count yours and find 5 petals and lay the flower on the right side of the 4-petal flower, how many petals all together? Yes, 9 petals. If we change the order put your 5-petal flower first and count petals, we still have the same total: 9 petals. Represent in written numbers to demonstrate how this looks. 4 + 5 = 9 5 = 4 = 9 Students create novel arrangements of objects, adding totals, then rearranging objects and again counting totals, and recording equations to demonstrate the Commutative property of addition. **Associative property of addition:** If we have a total of 14 beans divided into 3 groups (e.g., 2 + 6 + 6 = 14), we can first combine two of the groups (2+6 = 8) and add that number to the final number in the group 8 + 6 = 14 and get the same total number of beans. Represent the underlying equivalence numerically: 2 + 6 + 6 = 8 + 6 = 14. After many examples, let students generate their own novel arrangements and the numerical representations. • Math Plans & Ticklers: Sequence, p. 175 • Seeds! p.180 — combined with Math Plans & Ticklers: *Sequence*, p. 175 (skip microscope) (Use seeds from seed packs, seedpods, or from fruits and vegetables, cut open, to practice applying properties of operations for adding and subtracting.)
1.OA.4 4. Understand subtraction as an unknown-addend problem. For example, subtract 10 – 8 by finding the number that makes 10 when added to 8.	**4.** Students can use their loupe-study objects as manipulatives / counters in order **to help understand subtraction as an unknown-addend problem.** Objects serve as a concrete parallel to numerals. **Example:** subtract 10 – 8 by finding the number that makes 10 when added to 8. 10 leaves – 8 leaves = ☐ leaves … 8 leaves + ☐ leaves = 10 leaves (8 + 2 = 10 thus 10 - 8 = 2) • Math Plans & Ticklers: Sequence, p. 175 • Seeds! p. 180 — combined with Math Plans & Ticklers: *Sequence*, p. 175 (skip microscope) (Use seeds from seedpacks, seedpods, or cut segments of fruits and vegetables to loupe-examine then manipulate to understand subtraction as an unknown-addend problem.)

Common Core State Standards for Mathematics: GRADE 1

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

Add and subtract within 20.	**Add and subtract within 20.**
1.OA.5 5. Relate counting to addition and subtraction (e.g., by counting on 2 to add 2).	**5. Students relate counting to addition and subtraction** — within 20 — using loupe-study objects as counters (popcorn, beans, shells, leaves, pennies, oyster crackers, etc.). Teach students to use various strategies to understand the relationship between adding and subtracting. **E.g., Teach the strategy of "counting on"** to relate counting to addition. **Example of Counting On:** Show a student that if she starts with five beans and adds 2 more, she doesn't have to start over counting at the first bean to find the total # of beans but can continue counting from #5 and add on 2 for a total of 7 beans. The teacher shows students how to represent the equation in written numbers: 9 beans + 8 more beans = 17 beans 9 + 8 = 17 **Example:** 16 – 4 = ☐ **Counting All** (for subtraction): Student counts out 16 beans, then removes 4 of them. To determine the final amount, he counts each one for a total of 12. Then: 16 – 4 = 12 • Math Plans & Ticklers: Sequence, p. 175 • Seeds! p.180 (Skip the microscope.) Loupe-explore seeds from seed packets, pods, or from cut segments of fruits and vegetables — apples, oranges, sugar snap peas, etc. — then **relate counting of seeds to addition and subtraction strategies**.
1.OA.6 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).	**6.** Students continue to use loupe-study objects **to practice adding and subtracting within 20, and to help develop fluency for addition and subtraction within 10.** Teacher and students use their loupe-study objects (leaves, beans, pennies, shells, etc.) — or parts of objects (e.g., petals of a daisy) — to **demonstrate and practice strategies such as counting on; making ten; decomposing a number** leading to ten; etc. **Example:** Decompose a Number The problem: One student has 8 leaves, her partner has 7. How to figure how many leaves in all without counting? Teach a student to use what she already knows to solve a problem. One strategy: She can "**Decompose a Number":** If she knows that 7 = 5 + 2 she can break up (decompose) the 7 into a 2 and a 5. First she can add 8 + 2 (from the 7) to get 10, Then 10 + the remaining 5 (from the 7) = 15. Thus 8 + 7 = 15 • Math Plans & Ticklers: Sequence, p. 175 • Seeds! p.180 — combined with Math Plans & Ticklers: *Sequence*, p. 175 (skip microscope) (E.g., Use seeds from seed packs, seedpods, or cut segments of fruits and vegetables to loupe-examine then manipulate mathematically.)

Common Core State Standards for Mathematics: GRADE 1

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

Work with addition and subtraction equations.

1.OA.7

7. Understand the meaning of the equal sign, and determine if equations involving addition and subtraction are true or false. For example, which of the following equations are true and which are false? 6 = 6, 7 = 8 – 1, 5 + 2 = 2 + 5, 4 + 1 = 5 + 2.

1.OA.8

8. Determine the unknown whole number in an addition or subtraction equation relating to three whole numbers. For example, determine the unknown number that makes the equation true in each of the equations 8 + ? = 11, 5 = r - 3, 6 + 6 = r

Work with addition and subtraction equations:

7. A teacher can help students move quickly to **understand the meaning of the equal sign by introducing True-False equations** linked to loupe-study objects (pennies, popcorn, sunflower seeds in shells, acorns, etc.,), inlcuding objects with small parts (e.g. fruits, vegetables, branches with leaves, pussywillows on a stem, flowers). Working first with concrete models for abstract concepts, **students determine if equations involving addition and subtraction are true or false.**

Example: Each student has a giant-size equals sign (=) on card stock on his/her desk. The teacher writes True or False equations (numerals only) on a white board (and later on a handout). Students quickly assemble loupe-study objects on both sides of the equal sign to illustrate the statement on the board with a physical model on her desk, and chooses whether the statement is True or False. Students themselves then generate equations (based on manipulation of loupe-study objects as needed), and offer true-false equations for peers to solve, as well. Having the actual objects to manipulate can help many students verify their own conclusions and check the work of peers. Students then move to the abstraction of numerals only.

Which of the following equations are true and which are false?

5 = 5	5 popcorn kernels = 5 popcorn kernels	5 = 5? True)
7 = 8 – 1	7 seeds = 8 seeds – 1 seed (8 - 1 = 7)	7 = 7? True)
9 = 2 + 6	9 seeds = 2 seeds + 6 seeds … 2 + 6 = 8	9 = 8? False)
5 + 2 = 2 + 5	5 pennies + 2 pennies = 2 pennies + 5 pennies … 5 + 2 = 7	7 = 7? True
4 + 1 = 5 + 2	4 acorns + 1 acorn = 5 acorns + 2 acorns … 4 + 1 = 5, 5 + 2 = 7	5 = 7? False

- Math Plans & Ticklers: Sequence, p. 175
- Seeds! p.180 (Skip the microscope. Use seeds you collect or buy — sunflower seeds — or fruits and vegetables, cut open, to count/add/subtract seeds and create and manipulate equations in which students find the unknown number. Consider: Sugar snap peas, apples, oranges, etc.)

8. Students practice **determining / finding the unknown whole number in an addition or subtraction equation relating to three whole numbers** — using loupe-study objects as concrete models to bolster numerals-only work.

Example: determine the unknown number that makes the equation true in each of the equations:
8 seeds + ? seeds = 11 seeds (8 + ? = 11). Or: 5 flowers = r flowers - 3 flowers (5 = r – 3)
Or: 6 crackers + 6 crackers = r crackers (6 + 6 = r).

- Math Plans & Ticklers: Sequence, p. 175
- Seeds! p.180 (Skip the microscope. Use seeds you collect or buy — sunflower seeds — or fruits and vegetables, cut open, to count/add/subtract seeds and create and manipulate equations in which students find the unknown number. Consider: Sugar snap peas, apples, oranges, etc.)

Common Core State Standards for Mathematics: GRADE 1

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

Numbers and Operations in Base Ten 1.NBT	
Extend the counting sequence. **1.NBT.1** 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.	**Extend the Counting Sequence.** 8. Students extend the counting sequence to 120, starting at any number less than 120. **In this range students read and write numerals and represent them with a matching set of loupe-study objects. Converesely, in the range from 1 – 120, students count loupe-study objects (including mixed sets of objects** e.g., shells, beans, corn kernels, pussy willows, pebbles, small leaves, etc), **and represent the count with a written numeral, then read aloud those written numerals.** **Example:** Teachers challenge students to represent the numerals written on the board with pinto beans arranged by 10s in small paper cups. **Example:** Students create numerals for peers to represent. **Example of Group Activity**: Start with one student counting aloud objects in a set (or parts of objects, such as petals on a flower) — something he's been loupe-studying — then continue on around the room: the next student extends the count from wherever the previous student left off, counting off the numbers in his or her set, until reaching the goal of 120 objects (or parts of objects). Start again with a new count if need be for everyone to participate. (If a count ends in the midst of one student's set, she divides her set in two and begins the new count.) Along the way each student writes on an index card the numeral representing the number of objects in his/her personal set. Perhaps gather all 120 items together at the end to see what "120" of something looks like, how much it weights, how long a line it creates, etc. **Example:** Each student reaches a cup into a big jar of shells. pennies, stones, macaroni shells, etc., and scoops up a random number of objects. Each student counts aloud the number of objects in her set (as in the above example) and the next student begins where the previous student left off — until the count reaches 120. Then start again. Or students simply count the number of objects in their scoop and record the number. • Math Plans & Ticklers: Sequence, p. 175 • Count and Measure: Like Thoreau and Minna Pratt, p. 177

Common Core State Standards for Mathematics: GRADE 1

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

Understand place value. **1.NBT.2** 2. Understand that the two digits of a two-digit number represent amounts of tens and ones. Understand the following as special cases: a. 10 can be thought of as a bundle of ten ones — called a "ten." b. The numbers from 11 to 19 are composed of a ten and one, two, three, four, five, six, seven, eight, or nine ones. c. The numbers 10, 20, 30, 40, 50, 60, 70, 80, 90 refer to one, two, three, four, five, six, seven, eight, or nine tens (and 0 ones).	**Understand place value.** 2. Though plastic manipulatives are convenient, for an even more powerful, **real-world discovery lesson in place value**, students can work with multiples of loupe-examined objects that are easy to bag or bundle into groups of ten (e.g., use pinto beans, corn kernels, seeds, sunflower seeds in shells, popcorn, pennies, tiny shells, etc.). Students work independently or in table teams to count and arrange their "manipulatives" **to understand the concept that the two digits of a two-digit number represent amounts of tens and ones.** Students manipulate their loupe-study objects (individual and bundled by 10) to understand special cases: a. 10 can be thought of as a bundle of ten ones — called a "ten." b. The numbers from 11 to 19 are composed of a ten and one, two, three, four, five, six, seven, eight, or nine ones. c. The numbers 10, 20, 30, 40, 50, 60, 70, 80, 90 refer to one, two, three, four, d. five, six, seven, eight, or nine tens (and 0 ones). **Example: "**Pinto Bean Place Value". (Pinto beans have cool patterns under a loupe and evoke intriguing analogies in a "Loupe-List." There are science, nutrition and cultural connections to explore. For the math, don't tell students, but a typical one pound bag of pinto beans has about 1200 beans. Yes, we did a count!). Materials: Each student makes her own large place value mat (letter size sheet of paper) divided into two columns: Ten's Column on the left; One's Column to its right. Each student needs a starter bag of beans (containing between 40 – 99 beans) coded so the teacher knows the exact amount (for checking student work). Each student also needs 9 empty small plastic bags. After initial teacher demo, each student begins placing individual beans from their starter bag of beans into the Ones Column. Each time the number in the One's Column reaches 10, the student creates a *unit* of those items and labels it "1 Ten" (e.g., she puts the beans in a small plastic bag and labels the bag with a "1 Ten" — then moves that set (ten-Ones-in-a-bag) to its new place in the Tens Column. Table teams can work together to count the # of beans in part of a bag of pinto beans. If each student is able to make up to 9 bags of 10 beans each for the Tens Column and have some beans left over for the Ones Column — students can then practice generating different numbers representing the special cases noted (above) and representing them as two-digit numbers. • Math Plans & Ticklers: Sequence, p. 175 • Count and Measure: Like Thoreau and Minna Pratt, p. 177 • Seeds! p.180 (Skip the microscope. Use seeds from the garden, seedpacks, cut fruits & vegetables.)
1.NBT.3 3. Compare two two-digit numbers based on meanings of the tens and ones digits, recording the results of comparisons with the symbols >, =, and <.	3. **Students compare two two-digit numbers** based on meanings of the tens and ones digits. Again, they use their loupe-study objects to represent various combinations of two two-digit numbers. Choose two two-digit numbers and compare: Is one number bigger or smaller than the other? Are they equal? **Discuss and record results of comparisons using the symbols >, =, and <.** • Math Plans & Ticklers: Sequence, p. 175 • Count and Measure: Like Thoreau and Minna Pratt, p. 177 • Seeds! p.180 (Skip the microscope. Use seeds from the garden, seedpacks, cut fruits & vegetables.)

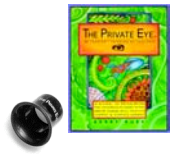
Common Core State Standards for Mathematics: GRADE 1

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

Use place value understanding and properties of operations to add and subtract.	**Use place value understanding and properties of operations to add and subtract.**
1.NBT.4 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.	4. **Students 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 loupe-study objects as concrete models** (e.g., use pinto beans, corn kernels, seeds, sunflower seeds in shells, popcorn, pennies, pine needles, tiny shells, etc., bagged or bundled into sets of ten with extra loose objects to represent "ones".). As they add within 100, students employ strategies based on place value, properties of operations, and/or the relationship between addition and subtraction. Students relate the strategy to a written method and can explain the reasoning used. They understand that in adding two-digit numbers, one adds tens and tens, ones and ones; and sometimes it is necessary to compose a ten. **Example:** Students manipulate sets of loupe-study objects that have been bagged or bundled into sets of tens for the Tens Column along with loose objects for the Ones Column — to practice adding two-digit numbers and a multiple of 10. (See "Pinto Bean Place Value" sets described in standard 1.NBT.2 above). The teacher says and writes a two-digit number on the board which each student must represent by placing the correct # of bundled or bagged sets (e.g., pinto beans) along with individual objects on a Place Value mat. The teacher then gives a second number — a multiple of 10 — to add to the first number. Students add objects, tally the results in the two columns and represent the addition problem and total with the corresponding written numeral. Students create problems for peers to represent, solve, and record. • Math Plans & Ticklers: Sequence, p. 175 • Seeds! p.180 (Skip the microscope. Use seeds from the garden, seedpacks, cut fruits & vegetables.) • Foxglove Towers, p. 180
1.NBT.5 5. Given a two-digit number, mentally find 10 more or 10 less than the number, without having to count; explain the reasoning used.	
1.NBT.6 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.	6. Students **subtract multiples of 10 in the range 10-90 from multiples of 10 in the range 10-90 (positive or zero differences) using loupe-study objects as concrete models** (e.g., use pinto beans, corn kernels, seeds, sunflower seeds in shells, popcorn, pennies, pine needles, tiny shells, etc., bagged or bundled into sets of ten with extra loose objects to represent "ones"). (For "How To" details, read the Example in 1.NBT.2) Students use strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; they relate the strategy to a written method and explain the reasoning used. **The teacher and students use the approach in the example above for 1.NBT.4 (adding within 100) but now apply it to subtraction problems.** • Math Plans & Ticklers: Sequence, p. 175 • Seeds! p.180 (Skip the microscope. Use seeds from the garden, seedpacks, cut fruits & vegetables.) • Foxglove Towers, p. 180

Measurement and Data **1.MD**	
Measure lengths indirectly and by iterating length units. **1.MD.1** 1. Order three objects by length; compare the lengths of two objects indirectly by using a third object. **1.MD.2** 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.*	**Measuring lengths indirectly and by iterating length units.** For this standard, have students **use a smaller loupe-study object (or part of an object) as a "measuring stick" for larger objects.** (Use the longest dimension of the object, e.g., use the length, not width, of a small leaf to "measure" the length of a branch or a section of a tree trunk.) 1. Students order three loupe-study objects by length: **Examples:** a. Use an *eraser* as the "measuring stick" unit by which to compare a post-it note's length to a pencil's. b. Use a leaf's *stem* as the measuring "tool" (standard unit) by which to compare the length of the leaf to the branch on which it hung. • Thoreau's Backpack and a Tape Measure, p. 177 • Leaf Math to Tree Math, p. 182 • The Root of It All: Ratio, p. 182 2. Revisit this standard to develop comparative thinking in a broader context — and have fun doing it! E.g., How many pennies long is a dollar bill? How many flower petals tall is the daisy's stem? How many pussy willow buds, end to end, would it take to span the whole branch? Students practice measuring the larger loupe-study object in terms of a smaller one. They lay multiple copies of the shorter object (the length unit) end to end to calculate a measure. (Explain to students that there might be slight gaps and that this experiment is an approximation: a case of "amost" or "about".) Students will deepen their understanding that the length measurement of an object is the number of same-size length units that span it. Thoreau's Backpack and a Tape Measure, p. 177 • Leaf Math to Tree Math, p. 182 • The Root of It All: Ratio, p. 182
Tell and write time. **1.MD.3** 3. Tell and write time in hours and half-hours using analog and digital clocks.	**Tell and write time.** 3. **In hours and half-hours, using both analog and digital clocks, students record in their journals (or on paperwork) the beginning time and end-time of Private Eye activities / projects.** **Example:** In extended observations of the same plant or animal, indoors or out, students record the date and time they make each observation in their journals, using both analog and digital clocks. • Math Plans & Ticklers: Sequence, p. 175 • Adopt a Seed, p. 144 or Adopt a Tree, p. 144 • Flower Power, p. 114 (Grow amaryllis bulb or paperwhites — or other plants — in class and mark down observed changes over elapsed time, and time of observation. • A Yard of Yard, p. 148 (Observe the same spot over time; record changes.)

Represent and interpret data. **1.MD.4** 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.	**Represent and interpret data.** 4. Students use loupe-study objects — and characteristics of those objects — as material to organize, represent, and interpret data with **up to three categories**. They can use one object with many characteristics to represent, or mixed specimens, e.g., samples of mixed sea shells or nuts or leaves. They 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. **Example:** Do a Survey. After students have loupe-studied popcorn, ask: "What is your favorite kind of popcorn?" Create a chart listing: Plain, Buttered, Salted, Buttered and Salted, Candied. Record each student's choice using their name/initials in the chosen category. Students total the amounts in each category and discuss the results. They write several sentences in their math journals about the data. • The Ultimate Portrait, p.177 – 178 • 36 Portraits with Statistics, p. 178 • Leaf Math to Tree Math, p. 182
Geometry **1.G**	
1.G.1 **Reason with shapes and their attributes.** 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. *Grade 1 shapes:* *2-dimensional: rectangles, squares, trapezoids, triangles, half circles, quarter circles* *3 dimensional: cubes, rectangular prisms, right circular cones, right circular cylinders* Students do not need to learn formal names. … Continued next page	**Reason with shapes and their attributes.** 1. To reinforce and practice the learning in this standard: **after students are able to recognize and draw shapes having specified attributes** (e.g triangles are closed and three-sided), **challenge students to look for geometric shapes in nature** — using the loupe to aid discovery and TPE Questions focused for math. **Example:** While loupe-observing something manmade (e.g., cloth or a sponge) or natural (the skin on your own hand) students ask themselves: "What math shapes can I find? What shape does this small part remind me of — in math?" **The discovery process requires students to "distinguish between defining attributes"** of 2-D and 3-D shapes. • Math Plans & Ticklers: Sequence, p. 175 • Traveling a Mathematical Loupe: Missing Piece, p. 176 (Students use their knowledge of basic shapes to infer the shape of a missing piece.) • Your Hand, p. 84 ("What else do the shapes in your hand remind you of? Why?") • Microcosm to Macrocosm p. 162 • Nature's Geometry, p. 176 … Continued next page



Reason with shapes and their attributes. (continued)

1.G.2

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.

1.G.3

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.

Reason with shapes and their attributes. (continued)

2. As an extension of this standard, **when students loupe-draw objects: challenge them to find the small geometric shapes that make up parts of the object they are observing. Challenge students to carefully draw — i.e., compose — the small, roughly geometric shapes and patterns that make up the object.** (For example, a loupe-observation of a sand dollar reveals hexagonal structures make up or tesselate the shell. To loupe-draw objects, natural or manmade, **students** "**compose two-dimensional shapes"** to represent one view of a three-dimensional shape.

- Drawing as Close Observation" p. 26; "Loupe-Draw" p. 125, and "Drawing Tips", p. 127 and 130.
- Nature's Geometry, p. 176
- For background knowledge for the teacher and to make things more exciting for advanced students: The Efficient Suitcase: Packing in Nature" p. 186-189
- For background knowledge for the teacher and to make things more exciting for advanced students: Tesselations, pp. 190-192

3. As students refine their sense of the whole vs. the part, they **use the language learned from partitioning circles and rectangles into two and four equal shares to describe shares of an individual loupe-study object** (e.g., a leaf, sand dollar, shell, flower, walnut in its shell, etc.). **In a focused lesson, the teacher directs students to use the words *halves, fourths, and quarters* and the phrases *half of, fourth of,* and *quarter of*** when they examine and describe their loupe-study object, or parts of that object. Model with a group lesson first, then students create individual loupe-analogy lists, writing, and experiments in which each partition phrase comes into play. Students should also practice the language of partitioning in the making and coloring of their loupe-drawings and artworks.

Example in Language*: The left half of the shell reminds me of…."*
"I'm looking at the first quarter of the stem and see a …" …
"To test whether the leaf sheds or holds onto water, I dipped half the leaf into water and found that…"

Example in Drawing for Close Observation and in Artwork*:* Students practice the language of partitioning also on their loupe-drawings and artworks. For variety and an exploration in perception, challenge students to loupe-draw just half the flower, or a fourth of the sand dollar. (Students can cover-up half of their object to help them in this.)

Example in Drawing for Close Observation and in Artwork*:* After student's have completed their black-and-white loupe-drawing the teacher leads a discussion which leads to action: "Today let's experiment: add color to only *half of* your drawing. How can we do that? Is there more than one way to color only half? Which half do you want to add color to? etc. Or "Today I want you to use only 4 colors. Make *a quarter of* the drawing one of the 4 colors. Should we divide the whole drawing into quarters?"

- Traveling a Mathematical Loupe: Missing Piece, p. 176
- Drawing Plans & Ticklers: "Sequence" and "5-in-1", p. 130
- Nature's Geometry, p. 176