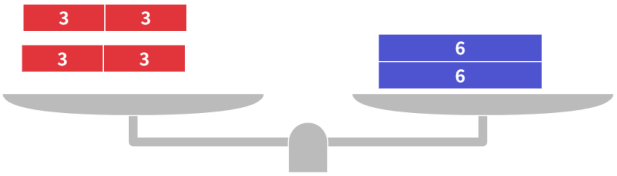
COASTMETRO

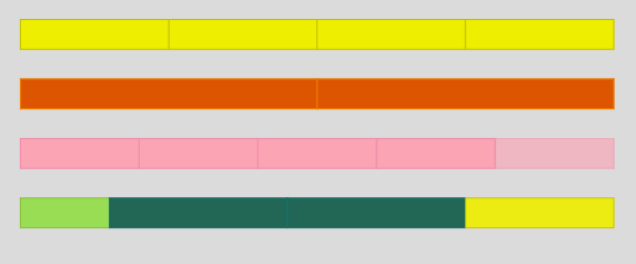
ELEMENTARY MATH PROJECT

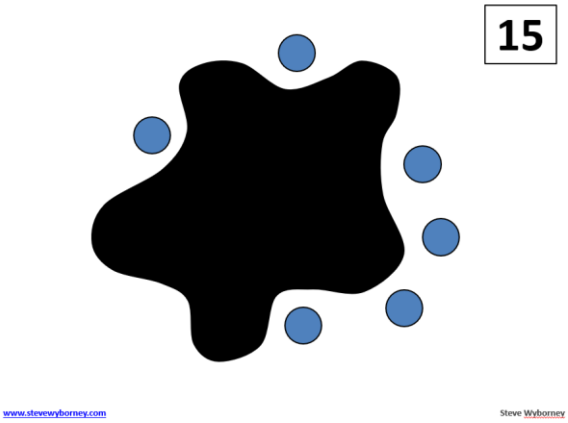
Grade 4
Patterning and Algebra
Key Number Concept 2: One-Step Equations
Sample Week at a Glance

Students will have explored the relationships between operations and understand opposite operations (addition/subtraction, multiplication/division), including work with basic fact families for operations (e.g., 3 x 5 = 15, 5 x 3 = 15, 15 ÷ 5 = 3, 15 ÷ 3 = 5). This may have happened directly before this week or earlier in the school year. This first lesson of this week offers a review and may be scheduled for a shorter time than other lessons, if appropriate for students.

Monday	**Focus:** relationships between operations (inverse or opposite operations) **Before:** Class discussion. Pose the question (with the equation projected for students to see), "I have a subtraction equation 15 - 7 = ▢. How can my addition facts help me figure out what goes on the right side of the equal sign?" After relating 7+ 8 = 15 to this equation, pose a question with division/multiplication and discuss (e.g., "I have a division problem 16 ÷ ▢ = 2 . How can my multiplication facts help me solve this equation?") **During:** Review fact families as a set of four related facts using opposite (inverse) operations e.g., (2 + 5 = 7 , 5 + 2 = 7, 7 - 2 = 5, 7- 5 = 2). Students engage in individual practice with dice, paper, and pencil. Students roll 2 dice (6-sided or 10-sided; 6-sided are enough for multiplication/division practice at this grade level). They use the resulting number to create a fact family, recording it on paper. Students could work in pairs, rolling one set of dice, individually writing the fact family, and buddy-checking their work. Examples:  I rolled 4 and 7. 7+4=11 11-4=7 4+7=11 11-7=4  I rolled 5 and 4. 5x4=20 20÷5=4 4x5=20 20÷4=5 *(images from Mathigon)*

	After: Come together as a whole group. On board, pose the problem, “What fact family could you create with 12 and 3?” Have students record their answers on paper or individual white boards. Discuss solutions.This extends the previous activity to use the sum or product in the given numbers and shows that a pair of numbers might be used for an addition/subtraction (e.g., 12 - 3 = 9) family AND a multiplication/division (e.g., 3 x 4 = 12)) family. Do more than one example as time permits. Consider collecting one or more samples from students for formative assessment purposes.
Tuesday	**Focus:** balanced equations **Before:** Class discussion: Pose a problem using a balance scale (virtual or concrete) such as this one (choose a number with many factors for a more interesting discussion):  *(image created with Polypad from Mathigon)* What number blocks can be used to balance the scale? Encourage discussion of a variety of answers (e.g., 10 and 2, 6 and 4 and 2, 1 and 1 and 1 and 9, etc.). Record equations as either 3 + 3 + 3 + 3 = (student responses) or 4 x 3 = (student answers). Then ask, “How can we balance using only one kind of number block?” One possible response is:  *(image created with Polypad from Mathigon)* 4 x 3 = 6 + 6 4 x 3 = 2 x 6 Record all student responses similarly. Note that each side of the equation is a different representation of the same value (here, 12) so the equation is considered balanced. Lead a similar discussion using Cuisenaire rods (magnetic or virtual such as https://nrich.maths.org/4348), asking students to contribute ideas to make trains of rods that are the same length (using white as value of 1). For example, a train can be made with four rods of 5 length for a total length of 20

	and other rods can be combined to the same length. Record equations to show equality, making sure to show some use multiplication. Solutions might look like:  5 + 5 + 5 + 5 = 10 + 10 4 x 5 = 10 + 10 4 x 5 = 2 x 10 4 x 5 = 3 + 6 + 6 + 5 10 + 10 = 5 x 4 *(image created with NRich Cuisenaire Environment)* **During:** Set up virtual or concrete balance scales and Cuisenaire rods and divide the students in two groups to explore one of these materials at a time. Create a set (5-7 for each manipulative) of challenge cards for balancing (by weight or length). For example, “Create a balanced scale that has 3 of one number on one side and more of another number on the other” or “Make a train of four 6s. Make several trains of the same length. Be sure one train is made of more rods, one made of fewer rods, and one is made from the same number of rods as the first train”. Students record equations on paper or individual white boards to represent their solutions. Switch groups half way through the allotted time for this activity. **After:** Consolidating discussion - pose one or two challenges from each type of manipulatives and invite students to share solutions. Record equations and discuss. Confirm that students understand that each side of the equal sign can have a different number of terms.
Wednesday	**Focus:** solving one-step equations with addition and subtraction Ideas: SPLAT Making riddles and translating to equation **Before:** Do a few Splat! Discussions as a whole group (choose from 1-10 Splats and 1-20 Splats). Demonstrate how a Splat! Image can be translated into an equation with an unknown in the first discussion and have students contribute equations on subsequent discussions. Example:

	 *Image from www.stevewyborney.com* Some equations related to this Splat! are: 15 = splat + 6 or 15 - 6 = splat or 6 + splat = 15 or 15 - splat = 6 **During:** Word problems with unknowns. Present one or two word problems that involve addition and/or subtraction, such as, “Morgan was putting apples in 3 baskets to fill customer orders. Morgan started with 12 apples and put 5 in one basket and 4 in another basket. How many apples did Morgan put in the third basket?” Discuss what equations could represent this problem and discuss the similarities and differences of the equations. For example, 12 = 5 + 4 + ? or 5 + 4 + ? = 12 or 12 - 5 - 4 = ? Discuss how students would solve to find the unknown. Individually, students create their own word problems and record an equation that represents the problem. They solve the equation for the unknown. After students have created a few problems, they partner up and share their problems. The partner records an equation and solves for the unknown and the two students compare their work. As students work, circulate and support students with their work. As needed, encourage students to create problems with different types of unknown (start unknown, change unknown, result unknown). **After:** Show What You Know exit ticket. Provide 1-2 word problems on paper for students to solve by recording a corresponding equation and solving for an unknown. Collect for formative assessment purposes. Adjust remaining lessons (e.g., inserting another lesson or making time for small group instruction while other students do math games or stations) as needed.
Thursday	**Focus:** solving one-step equations with multiplication and division using number concrete and pictorial representations. **Before:** Class discussion in two parts - pose a question such as, “How can a number line help us find the unknown value in ▢ x 2 = 24?” Using a number line drawn or projected onto the board, record students’ contributions. One answer might be, “We can see how many times we skip count by 2 to get to 24.” Additionally, using virtual manipulatives, chips with a document camera, or magnets, pose a question such as, “How can an array help us solve 16 ÷ ▢

= 8? “ and use manipulatives to demonstrate students’ answers.

During: Math workshop (stations)

- Solving with number lines - provide dry-erase (laminated) number lines and cards with equations with unknowns (multiplication and division with samples of all types of unknowns)
- Solving with arrays - provide chips or other manipulatives and cards with equations with unknowns (multiplication and division with samples of all types of unknowns)
- Splat! - provide cards with multiple splats and a total. Students record a multiplication equation (start or change unknown) or division equation (change or result unknown) that matches the picture. Provide felt splats and counters as concrete materials.
- Balance scales - leverage experience from Tuesday’s lesson - provide cards with one “weight” on one side of the scale and one sample weight on the other side (vary which side has the single weight).. Record an equation to match the scenario and use virtual or concrete balance scale to solve. Example:

24 = ▢ x 6 or 24 ÷ 6 = ▢

(images created with Polypad from Mathigon)

- Cuisenaire rods - leverage experience from Tuesday’s lesson - provide cards with one train made of one kind of rod and ask, “How many [factor of train length] rods would make a train of the same length?’ Students record an equation and solve it. Provide concrete or virtual Cuisenaire rods. Example:

▢ x 4 = 24 or ▢ x 4 = 3 x 8 or 24 ÷ 4 = ? or 24 ÷ ? = 4

(image created with NRich Cuisenaire Environment)

After: Class discussion - How is your knowledge of basic facts of multiplication and division helping you find the unknown quantity in equations? (Note: this

	will be reinforced and extended in the “Before” part of Friday’s lesson)
Friday	**Focus:** solving one-step equations with multiplication and division using fact families and opposite operations **Optional warm-up:** students may be ready to solve Splat! puzzles from the Multiple Splat collections by Steve Wyborney **Before:** Class discussion - pose the question “How can understanding how multiplication and division are related help us find the unknown in equations? For example, 18 ÷ ▢ = 6 .” Help students connect to fact families and that multiplication is the opposite operation to division as necessary. **During:** Math workshop (stations) and small group work - repeat stations from Thursday possibly adding one that involves creating and solving a word problem (with multiplication or division) and/or one or two math game stations (such as Net Zero game by Bay-Williams and Kling - video instructions provided by Love Maths https://www.lovemaths.me/operations-f-2) as needed. Students rotate through stations while the teacher pulls small groups to work on solving for unknowns by relating to fact families and opposite operations (use this small group time to collect information for formative assessment to plan additional whole class or small group instruction if necessary). **After:** Class discussion - What is your preferred method of solving for unknowns with equations that involve multiplication and/or division? Why is that your preferred way? (Provide an equation to anchor the discussion as necessary.) Students may give an “it depends” answer with explanation.

This sample week may be enough for students to reach proficiency in the learning standards for one-step equations in Grade 4. It is possible that a couple more lessons (or repeats of the outlined stations and small group work) focusing on equations involving multiplication and division may be needed, depending on students’ previous experiences with these concepts. Cognitive science principles encourage revisiting concepts throughout the year. Consider having students play games and play with balance scales over the rest of the school year and pose one-step equations for solving as an opening or closing activity.