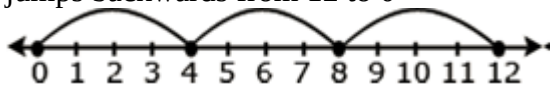
<table>
<tr><td>Grade: 3

Unit 2- Determine Unknown Whole Numbers in Multiplication and Division</td><td colspan="2">Subject: Math
Time Frame: 26 days
Domains: Operations and Algebraic Thinking; Measurement and Data; Number and Operations in Base Ten</td></tr>
<tr><td>Standards</td><td>Content Standards:
3.OA.1, 3.OA.2, 3.OA.3, 3.OA.4, 3.OA.5, 3.OA.6, 3.OA.7, 3.OA.8, 3.OA.9, 3.MD.5a, 3.MD.5b,3.MD.7a, 3.MD.7b, 3.NBT.3
http://www.corestandards.org/wp-content/uploads/Math_Standards.pdf</td><td>Practice Standards:
MP 1, 2, 3, 4, 5, 6, 7, 8</td></tr>
<tr><td>Enduring Understandings</td><td colspan="2">1. Patterns can help us multiply.
2 Multiplication and division are related operations.
3. Different strategies can be used to multiply and divide.
4. Patterns can be used to multiply and divide with 6, 7, and 8s.
5. Area models can be used for multiplications.
6. Patterns, properties, rules and area can help us multiply and divide.
7. Multiplication and division are needed to solve real world problems.</td></tr>
<tr><td>Essential Questions</td><td colspan="2">1. How do we use patterns to multiply with 5?
2. How can we use multiplication and drawings to represent equal group situations?
3. How can we use multiplication and drawings to represent array situations and the Commutative Property?
4. How are multiplication and division related?
5. How can we use the area model for multiplication?
6. How can we use strategies to build fluency with 6s, 7s, and 8s in multiplication and division?
7. How can we use different strategies to solve and create multiplication and division word problems?
8. How can we identify and use patterns, properties, rules and area to multiply and divide?
9. How can we use place value models to multiply?</td></tr>
</table>

Vocabulary	Array, product, length, width, area, Fast Area Drawing, Fast Array Drawing, array problem, equal groups problem, area problem, square number, multiple, function table

Priority and Supporting CCSS	Explanations and Examples*
3.OA.1 Interpret products of whole numbers, e.g., interpret 5 × 7 as the total number of objects in 5 groups of 7 objects each. For example, describe a context in which a total number of objects can be expressed as 5×7.	**3.OA.1**. Students recognize multiplication as a means to determine the total number of objects when there are a specific number of groups with the same number of objects in each group. Multiplication requires students to think in terms of groups of things rather than individual things. Students learn that the multiplication symbol 'x' means "groups of" and problems such as 5 x 7 refer to 5 groups of 7. To further develop this understanding, students interpret a problem situation requiring multiplication using pictures, objects, words, numbers, and equations. Then, given a multiplication expression (e.g., 5 x 6) students interpret the expression using a multiplication context. (See Table 2) They should begin to use the terms, factor and product, as they describe multiplication. Students may use interactive whiteboards to create digital models.

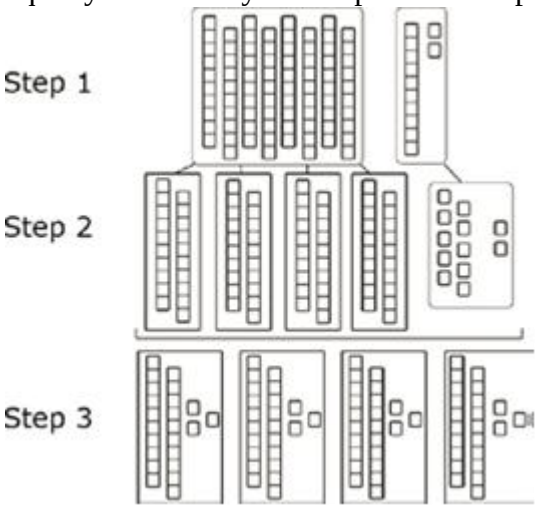
Priority and Supporting CCSS	Explanations and Examples*
3.OA.2 Interpret whole-number quotients of whole numbers, e.g., interpret 56 ÷ 8 as the number of objects in each share when 56 objects are partitioned equally into 8 shares, or as a number of shares when 56 objects are partitioned into equal shares of 8 objects each. For example, describe a context in which a number of shares or a number of groups can be expressed as 56 ÷ 8.	**3.OA.2**. Students recognize the operation of division in two different types of situations. One situation requires determining how many groups and the other situation requires sharing (determining how many in each group). Students should be exposed to appropriate terminology (quotient, dividend, divisor, and factor). To develop this understanding, students interpret a problem situation requiring division using pictures, objects, words, numbers, and equations. Given a division expression (e.g., 24 ÷ 6) students interpret the expression in contexts that require both interpretations of division. Students may use interactive whiteboards to create digital models.

Priority and Supporting CCSS	Explanations and Examples*
3.OA.3 Use multiplication and division within 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.	**3.OA.3.** Students use a variety of representations for creating and solving one-step word problems, i.e., numbers, words, pictures, physical objects, or equations. They use multiplication and division of whole numbers up to 10 x10. Students explain their thinking, show their work by using at least one representation, and verify that their answer is reasonable. Word problems may be represented in multiple ways: • Equations: 3 x 4 = __, 4 x 3 = __, 12 ÷ 4 =__ and 12 ÷ 3 = __ • Array:  • Equal groups  • Repeated addition: 4 + 4 + 4 or repeated subtraction • Three equal jumps forward from 0 on the number line to 12 or three equal jumps backwards from 12 to 0 

Examples of division problems:

• Determining the number of objects in each share (partitive division, where the size of the groups is unknown):

The bag has 92 hair clips, and Laura and her three friends want to share them equally. How many hair clips will each person receive?



• Determining the number of shares (measurement division, where the number of groups is unknown)

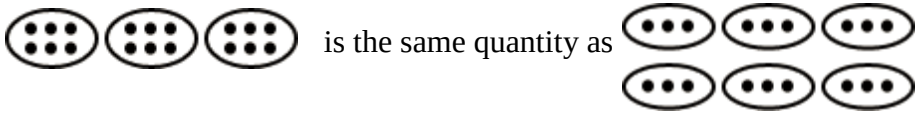
Max the monkey loves bananas. Molly, his trainer, has 24 bananas. If she gives Max 4 bananas each day, how many days will the bananas last?

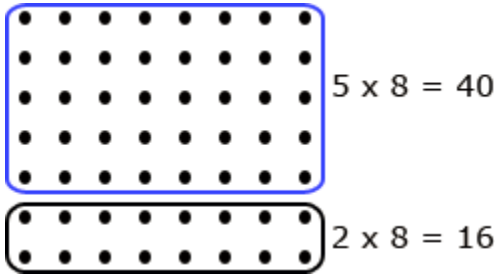
Starting	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
24	24-4=20	20-4=16	16-4=12	12-4=8	8-4=4	4-4=0

Solution: The bananas will last for 6 days.

Students may use interactive whiteboards to show work and justify their thinking.

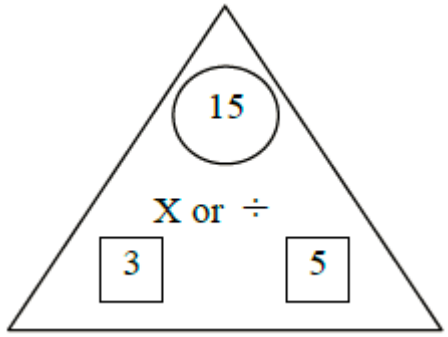
Priority and Supporting CCSS	Explanations and Examples*
3.OA.4. Determine the unknown whole number in a multiplication or division equation relating three whole numbers. For example, determine the unknown number that makes the equation true in each of the equations 8 × __ = 48, 5 = __÷ 3, 6 × 6 = __	**3.OA.4**. This standard is strongly connected to 3.AO.3 when students solve problems and determine unknowns in equations. Students should also experience creating story problems for given equations. When crafting story problems, they should carefully consider the question(s) to be asked and answered to write an appropriate equation. Students may approach the same story problem differently and write either a multiplication equation or division equation. Students apply their understanding of the meaning of the equal sign as ”the same as” to interpret an equation with an unknown. When given 4 x __ = 40, they might think: • 4 groups of some number is the same as 40 • 4 times some number is the same as 40 • I know that 4 groups of 10 is 40 so the unknown number is 10 • The missing factor is 10 because 4 times 10 equals 40. Equations in the form of a x b = c and c = a x b should be used interchangeably, with the unknown in different positions. Examples: • Solve the equations below: 24 = __ x 6 72÷9= __ • Rachel has 3 bags. There are 4 marbles in each bag. How many marbles does Rachel have altogether? 3 x 4 = __ Students may use interactive whiteboards to create digital models to explain and justify their thinking.

3.OA.5. Apply properties of operations as strategies to multiply and divide.* Examples: If 6 × 4 = 24 is known, then 4 × 6 = 24 is also known. (Commutative Property of Multiplication.) 3 × 5 × 2 can be found by 3 × 5 = 15, then 15 × 2 = 30, or by 5 × 2 = 10, then 3 × 10 = 30. (Associative Property of Multiplication.) Knowing that 8 × 5 = 40 and 8 × 2 = 16, one can find 8 × 7 as 8 × (5 + 2) = (8 × 5) + (8 × 2) = 40 + 16 = 56. (Distributive Property.) * Students need not use formal terms for these properties.	**3.OA.5**. Students represent expressions using various objects, pictures, words and symbols in order to develop their understanding of properties. They multiply by 1 and 0 and divide by 1. They change the order of numbers to determine that the order of numbers does not make a difference in multiplication (but does make a difference in division). Given three factors, they investigate changing the order of how they multiply the numbers to determine that changing the order does not change the product. They also decompose numbers to build fluency with multiplication. Models help build understanding of the Commutative Property: Example: 3 x 6 = 6 x 3 In the following diagram it may not be obvious that 3 groups of 6 is the same as 6 groups of 3. A student may need to count to verify this.  Example: 4 x 3 = 3 x 4 An array explicitly demonstrates the concept of the Commutative Property.  4 rows of 3 or 4 x 3 3 rows of 4 or 3 x 4

3.OA.6. Understand division as an unknown-factor problem. For example, find 32 ÷ 8 by finding the number that makes 32 when multiplied by 8.	Students are introduced to the Distributive Property of Multiplication over addition as a strategy for using products they know to solve products they don't know. For example, if students are asked to find the product of 7 x 8, they might decompose 7 into 5 and 2 and then multiply 5 x 8 and 2 x 8 to arrive at 40 + 16 or 56. Students should learn that they can decompose either of the factors. It is important to note that the students may record their thinking in different ways. 5 x 8 = 40 2 x 8 = 16 56  **3.OA.6**. Multiplication and division facts are inverse operations and that understanding can be used to find the unknown. Fact family triangles demonstrate the inverse operations of multiplication and division by showing the two factors and how those factors relate to the product and/or quotient.

Examples:

- 3 x 5 = 15 5 x 3 = 15
- 15 ÷ 3 = 5 15 ÷ 5 = 3



Students use their understanding of the meaning of the equal sign as "the same as" to interpret an equation with an unknown. When given 32 ÷__ = 4, students may think:

- 4 groups of some number is the same as 32
- 4 times some number is the same as 32
- I know that 4 groups of 8 is 32 so the unknown number is 8
- The missing factor is 8 because 4 times 8 is 32.

Equations in the form of a ÷ b = c and c = a ÷ b need to be used interchangeably, with the unknown in different positions.

3.OA.7. Fluently multiply and divide within 100, using strategies such as the relationship between multiplication and division (e.g., knowing that 8 × 5 = 40, one knows that 40 ÷ 5 = 8) or properties of operations. By the end of grade 3, know from memory all products of two one-digit numbers.	**3.OA.7.** By studying patterns and relationships in multiplication facts and relating multiplication and division, students build a foundation for fluency with multiplication and division facts. Students demonstrate fluency with multiplication facts through 10 and the related division facts. Multiplying and dividing fluently refers to knowledge of procedures, knowledge of when and how to use them appropriately, and skill in performing them flexibly, accurately, and efficiently. Strategies students may use to attain fluency include: • Multiplication by zeros and ones • Doubles (2s facts), Doubling twice (4s), Doubling three times (8s) • Tens facts (relating to place value, 5 x 10 is 5 tens or 50) • Five facts (half of tens) • Skip counting (counting groups of __ and knowing how many groups have been counted) • Square numbers (ex: 3 x 3) Strategies students may use to attain fluency include: • Nines (10 groups less one group, e.g., 9 x 3 is 10 groups of 3 minus one group of 3) • Decomposing into known facts (6 x 7 is 6 x 6 plus 1 more group of 6) • Turn-around facts (Commutative Property) • Fact families (Ex: 6 x 4 = 24; 24 ÷ 6 = 4; 24 ÷ 4 = 6; 4 x 6 = 24) • Missing factors

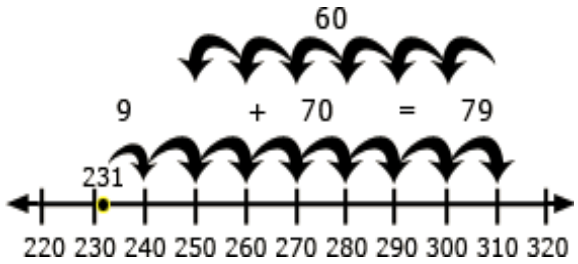
3.OA.8 Solve two-step word problems using the four operations. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.*

* This standard is limited to problems posed with whole numbers and having whole-number answers; students should know how to perform operations in the conventional order when there are no parentheses to specify a particular order (Order of Operations).

3.OA.8. Students should be exposed to multiple problem-solving strategies (using any combination of words, numbers, diagrams, physical objects or symbols) and be able to choose which ones to use.

Examples:

• Jerry earned 231 points at school last week. This week he earned 79 points. If he uses 60 points to earn free time on a computer, how many points will he have left?

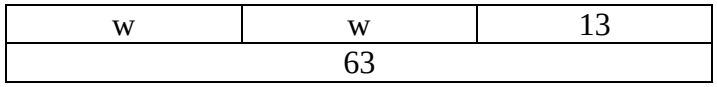


A student may use the number line above to describe his/her thinking, "231 + 9 = 240 so now I need to add 70 more. 240, 250 (10 more), 260 (20 more), 270, 280, 290, 300, 310 (70 more). Now I need to count back 60. 310, 300 (back 10), 290 (back 20), 280, 270, 260, 250 (back 60)."

A student writes the equation, 231 + 79 – 60 = __ and uses rounding (230 + 80 – 60) to estimate.

A student writes the equation, 231 + 79 – 60 = __ and calculates 79 – 60 = 19 and then calculates 231 + 19 = __.

• The soccer club is going on a trip to the water park. The cost of attending the trip is $63. Included in that price is $13 for lunch and the cost of 2 wristbands, one for the morning and one for the afternoon. Write an equation representing the cost of the field trip and determine the price of one wristband.



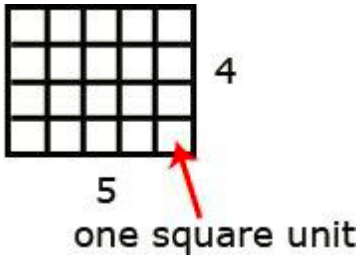
The above diagram helps the student write the equation, w + w + 13 = 63. Using the diagram, a student might think, "I know that the two wristbands cost $50 ($63-$13) so one wristband costs $25." To check for reasonableness, a student might use front end estimation and say 60-10 = 50 and 50 ÷ 2 = 25.

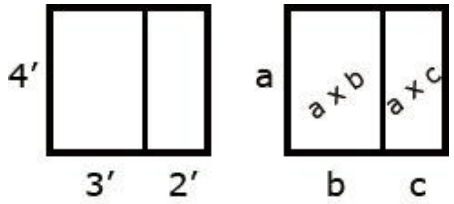
When students solve word problems, they use various estimation skills which include identifying when estimation is appropriate, determining the level of accuracy needed, selecting the appropriate method of estimation, and verifying solutions or determining the reasonableness of solutions.

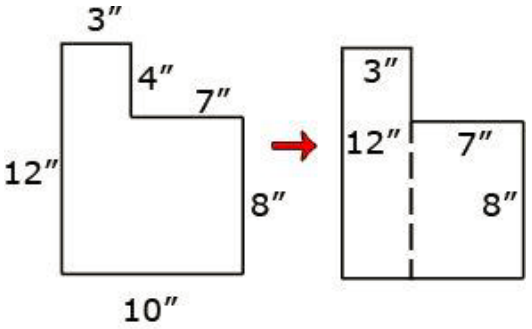
Estimation strategies include, but are not limited to:

- using benchmark numbers that are easy to compute
- front-end estimation with adjusting (using the highest place value and estimating from the front end making adjustments to the estimate by taking into account the remaining amounts)
- rounding and adjusting (students round down or round up and then adjust their estimate depending on how much the rounding changed the original values)

3.OA.9 Identify arithmetic patterns (including patterns in the addition table or multiplication table), and explain them using properties of operations. ***For example, observe that 4 times a number is always even, and explain why 4 times a number can be decomposed into two equal addends.***	**3.OA.9**. Students need ample opportunities to observe and identify important numerical patterns related to operations. They should build on their previous experiences with properties related to addition and subtraction. Students investigate addition and multiplication tables in search of patterns and explain why these patterns make sense mathematically. For example: • Any sum of two even numbers is even • Any sum of two odd numbers is even • Any sum of an even number and an odd number is odd • The multiples of 4, 6, 8, and 10 are all even because they can all be decomposed into two equal groups • The doubles (2 addends the same) in an addition table fall on a diagonal while the doubles (multiples of 2) in a multiplication table fall on horizontal and vertical lines • The multiples of any number fall on a horizontal and a vertical line due to the commutative property • All the multiples of 5 end in a 0 or 5 while all the multiples of 10 end with 0 Every other multiple of 5 is a multiple of 10 Students also investigate a hundreds chart in search of addition and subtraction patterns. They record and organize all the different possible sums of a number and explain why the pattern makes sense.
3.MD.5. Recognize area as an attribute of plane figures and	

understand concepts of area measurement. **a. A square with side length 1 unit, called "a unit square," is said to have "one square unit" of area, and can be used to measure area.** **b. A plane figure which can be covered without gaps or overlaps by *n* unit squares is said to have an area of *n* square units.** **3.MD.7. Relate area to the operations of multiplication and**	**3.MD.5.** Students develop understanding of using square units to measure area by: • Using different sized square units • Filling in an area with the same sized square units and counting the number of square units • An interactive whiteboard would allow students to see that square units can be used to cover a plane figure. 

addition. **a. Find the area of a rectangle with whole-number side lengths by tiling it, and show that the area is the same as would be found by multiplying the side lengths.** **b. Multiply side lengths to find areas of rectangles with whole-number side lengths in the context of solving real world and mathematical problems, and represent whole-number products as rectangular areas in mathematical reasoning.**	**3.MD.7.** Students tile areas of rectangles, determine the area, record the length and width of the rectangle, investigate the patterns in the numbers, and discover that the area is the length times the width. Example: Joe and John made a poster that was 4' by 3'. Mary and Amir made a poster that was 4' by 2'. They placed their posters on the wall side-by-side so that that there was no space between them. How much area will the two posters cover? Students use pictures, words, and numbers to explain their understanding of the Distributive Property in this context.  4 x 3 + 4 x 2 = 20 4 x 5 = 20

3.NBT.3. Multiply one-digit whole numbers by multiples of 10	Example: Students can decompose a rectilinear figure into different rectangles. They find the area of the figure by adding the areas of each of the rectangles together.  area is 12 x 3 + 8 x 7 = 92 sq inches

in the range 10–90 (e.g., 9 × 80, 5 × 60) using strategies based on place value and properties of operations. * ***** A range of algorithms may be used.	**3.NBT.3.** Students use base ten blocks, diagrams, or hundreds charts to multiply one-digit numbers by multiples of 10 from 10-90. They apply their understanding of multiplication and the meaning of the multiples of 10. For example, 30 is 3 tens and 70 is 7 tens. They can interpret 2 x 40 as 2 groups of 4 tens or 8 groups of ten. They understand that 5 x 60 is 5 groups of 6 tens or 30 tens and know that 30 tens is 300. After developing this understanding they begin to recognize the patterns in multiplying by multiples of 10. Students may use manipulatives, drawings, document camera, or interactive whiteboard to demonstrate their understanding.

Resources

Math Expressions – Unit 2, Lessons 1-15
Soar to Success Math Intervention
Mega Math
Common Core Mathematics-Newmark Learning- Units 6-12
Xtramath.org
Moby Max

Unit Assessments
Unit Test Quick Quizzes Formative Assessments Performance Task

Technology: Videos, Websites, Links
https://grade3commoncoremath.wikispaces.hcpss.org/ www.learnsillion.com http://mathworksheetsland.com/3/ www.thinkcentral.com