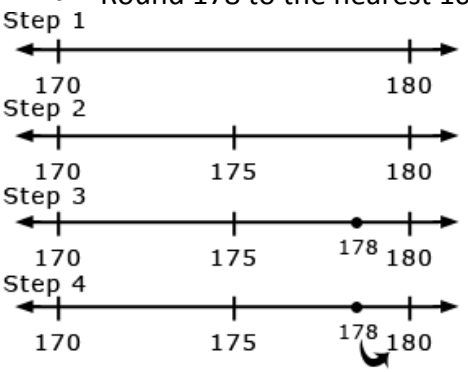
Elementary Math Curriculum

Grade/Subject	Grade 3/Mathematics
Unit Title	Unit 6/Computing with Whole Numbers Using Addition and Subtraction
Overview of Unit	The conceptual focus of this unit is to use place value understanding and properties of operations to perform accurate computations. Students will learn multiple strategies, solve addition and subtraction problems, and estimate to determine if an answer is reasonable, in order to independently plan field trips for the year, compute mileage, compare totals, and defend choices.
Pacing	15 days (includes 2 days for review and assessment)

Core Content Standards	Explanations and Examples (Developed by Arizona DOE)
3.NBT.1 Use place value understanding to round whole numbers to the nearest 10 or 100.	Students learn when and why to round numbers. They identify possible answers and halfway points. Then they narrow where the given number falls between the possible answers and halfway points. They also understand that by convention if a number is exactly at the halfway point of the two possible answers, the number is rounded up. Example: • Round 178 to the nearest 10.  Step 1: The answer is either 170 or 180. Step 2: The halfway point is 175. Step 3: 178 is between 175 and 180. Step 4: Therefore, the rounded number is 180.
3.NBT.2 Fluently add and subtract within 1000 using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction.	Problems should include both vertical and horizontal forms, including opportunities for students to apply the commutative and associative properties. Adding and subtracting fluently refers to knowledge of

Core Content Standards	Explanations and Examples (Developed by Arizona DOE)
	procedures, knowledge of when and how to use them appropriately, and skill in performing them flexibly, accurately, and efficiently. Students explain their thinking and show their work by using strategies and algorithms, and verify that their answer is reasonable. An interactive whiteboard or document camera may be used to show and share student thinking. Example: • Mary read 573 pages during her summer reading challenge. She was only required to read 399 pages. How many extra pages did Mary read beyond the challenge requirements? Students may use several approaches to solve the problem including the traditional algorithm. Examples of other methods students may use are listed below: • **399 + 1 = 400, 400 + 100 = 500, 500 + 73 = 573, therefore 1+ 100 + 73 = 174 pages (Adding up strategy)** • **400 + 100 is 500; 500 + 73 is 573; 100 + 73 is 173 plus 1 (for 399, to 400) is 174 (Compensating strategy)** • **Take away 73 from 573 to get to 500, take away 100 to get to 400, and take away 1 to get to 399. Then 73 +100 + 1 = 174 (Subtracting to count down strategy)** • **399 + 1 is 400, 500 (that's 100 more). 510, 520, 530, 540, 550, 560, 570, (that's 70 more), 571, 572, 573 (that's 3 more) so the total is 1 + 100 + 70 + 3 = 174 (Adding by tens or hundreds strategy)**
Standards for Mathematical Practice	**Explanations and Examples**
1. Make sense of problems and persevere in solving them 2. Reason abstractly and quantitatively 3. Construct viable arguments and critique the reasoning of others 4. Model with mathematics 5. Use appropriate tools strategically 6. Attend to precision 7. Look for and make use of structure 8. Look for and express regularity in repeated reasoning	**MP.1** Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic

Core Content Standards	Explanations and Examples (Developed by Arizona DOE)
	expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, "Does this make sense?" They can understand the approaches of others to solving complex problems and identify correspondences between different approaches. **MP.2** Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects. **MP.3** Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about

Core Content Standards	Explanations and Examples (Developed by Arizona DOE)
	data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments. **MP.4** Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose. **MP.5** Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete

Core Content Standards	Explanations and Examples (Developed by Arizona DOE)
	models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts. **MP.6** Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions. **MP.7** Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how

Core Content Standards	Explanations and Examples (Developed by Arizona DOE)
	many sides the shapes have. Later, students will see 7 × 8 equals the well-remembered 7 × 5 + 7 × 3, in preparation for learning about the distributive property. In the expression x2 + 9x + 14, older students can see the 14 as 2 × 7 and the 9 as 2 + 7. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see 5 – 3(x – y)2 as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers x and y. **MP.8** Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation (y – 2)/(x – 1) = 3. Noticing the regularity in the way terms cancel when expanding (x – 1)(x + 1), (x – 1)(x2 + x + 1), and (x – 1)(x3 + x2 + x + 1) might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.
ISTE Standards	
(http://www.iste.org/standards/nets-for-students.aspx) 1. Creativity nets.s.1.c 4. Critical Thinking, Problem Solving, and Decision Making nets.s.4.a nets.s.4.d	

Core Content Standards	Explanations and Examples (Developed by Arizona DOE)
5. Digital Citizenship nets.s.5.a nets.s.5.b nets.s.5.c nets.s.5.d	
K-U-D	
KNOW *Facts, formulas, information, vocabulary*	**DO** *Skills of the discipline, social skills, production skills, processes (usually verbs/verb phrases)* *Hint: Use the standards!*
• Computation strategies (e.g., composing and decomposing numbers, adding up, compensating, subtracting down, adding by tens) • Compatible numbers • Place value (based on groups of ten) • Estimation strategies (rounding, number lines, etc.) • Fact families • Commutative property • Associative property • Approximate Numbers Key Vocabulary • **Addend**- A number to be added in an addition number sentence. (2+5+7, 2,5, and 7 are the addends) • **Algorithm** – a step-by-step method for computing • **Associative Property of Addition**– changing the grouping of three or more addends does not change the sum • **Commutative Property of Addition**– changing the order of the addends does not change the sum • **Decompose** – to separate into components or basic elements (ex: 342 = 300 + 40 + 2) • **Estimate** – to find a number close to an exact amount; an estimate tells about how much or about how many • **Fact Family**- a group of related facts that use the same numbers • **Identity Property of Addition** – if you add zero to a number, the sum is the same as that number • **Parentheses** – used in mathematics as grouping symbols for operations	• Add and subtract fluently within 1000 using strategies and algorithms based on place value, properties and/or relationship between addition and subtraction • Round whole numbers to the nearest 10 or 100 using place value • Use estimation strategies to check the reasonableness of an answer • Verify that the answer is reasonable

Core Content Standards	Explanations and Examples (Developed by Arizona DOE)
• **Place Value** – the value (what the number is worth) of the place of a digit in a number • **Reasonableness** – an answer that is based on good number sense • **Sum**- The result of adding numbers • **Turnaround fact**- A pair of facts in which order of the digits is reversed. For the fact 2 + 6 = 8 the turnaround fact is 6 + 2 = 8	

UNDERSTAND

Big ideas, generalizations, principles, concepts, ideas that transfer across situations

- Students will understand **that** in real-life situations you can use an estimate rather than have an exact answer.
- Students will understand **that** a relationship exists between addition and subtraction.
- Students will understand **that** estimation can help us to justify the reasonableness of an answer and to help us solve problems.
- Students will understand **that** place value knowledge and knowledge of the properties can be used to solve problems by taking apart and combining numbers in a wide variety of ways.

Vocabulary

Domain-Specific Vocabulary

- Addend- A number to be added in an addition number sentence. (2+5+7, 2,5, and 7 are the addends)
- Algorithm – a step-by-step method for computing
- Associative Property of Addition– changing the grouping of three or more addends does not change the sum
- Approximate Numbers-find a result that is close to the right answer.
- Commutative Property of Addition– changing the order of the addends does not change the sum
- Decompose – to separate into components or basic elements (ex: 342 = 300 + 40 + 2)
- Digit- one of the symbols 0,1,2,3,4,5,6,7,8,9, used to write numbers.
- Estimate – to find a number close to an exact amount; an estimate tells about how much or about how many
- Fact Family- a group of related facts that use the same numbers
- Identity Property of Addition – if you add zero to a number, the sum is the same as that number
- Parentheses – used in mathematics as grouping symbols for operations
- Place Value – the value (what the number is worth) of the place of a digit in a number
- Reasonableness – an answer that is based on good number sense
- Round- to estimate a number to the nearest ten, hundred, or thousand, etc.
- Sum- The result of adding numbers

- Turnaround fact- A pair of facts in which order of the digits is reversed. For the fact 2 + 6 = 8 the turnaround fact is 6 + 2 = 8

Interdisciplinary Connections

Interdisciplinary Connections

Literacy connections (see books above).

a) Students can create story problems based on the book. Classmates can try to solve each other's problems.

b) Math Read aloud task cards involving literature:http://www.k5mathteachingresources.com/3rd-grade-number-activities.html

Real World application

a) Pose addition and subtraction problems involving shopping, sharing a bill, etc.

Work Cited

Van de Walle, J., & Lovin, L. H. (2006). *Teaching student-centered mathematics, grades 3-5*. New York, NY: Allyn & Bacon.

Mentoring Minds, Motivation Math, Level 3 (2012-2013). Tyler, TX: Jujan, M.L.

Elementary Math Curriculum

Grade/Subject	Grade 3/ Mathematics
Unit Title	Unit 2 – **Understanding** Multiplication & Division
Overview of Unit	The unit involves representing and solving multiplication and division problems using an understanding of the properties of operations. Students will learn multiple strategies to represent multiplication and division problems. Students will understand the connection of between multiplication and division as well as the connections to addition and subtraction. Operation sense supports student effective application of these operations (Van De Walle, 2014)
Pacing	**15 days** (plus **5 days** for reteaching/enrichment)

Core Content and Practice Standards	Explanations and Examples*
<u>Core Content</u> 3.OA.1- Interpret products of whole numbers, e.g., interpret 5x7 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 5x7.*	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.
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)

Core Content and Practice Standards	Explanations and Examples*
	students interpret the expression in contexts that require both interpretations of division. Students may use interactive whiteboards to create digital models.
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. addend | addend | sum 0 | 20 | 20 1 | 19 | 20 2 | 18 | 20 3 | 17 | 20 4 | 16 | 20 • | • | • • | • | • • | • | • 20 | 0 | 20
<u>Practice Standards</u> *Practices in bold are to be emphasized in the unit.* 1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.	

Elementary Math Curriculum

ISTE Standards

NETS.S.1.C - Creativity and Innovation

Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology.

c. Use models and simulations to explore complex systems and issues

NETS.S.2.B - Communication and Collaboration

Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.

b. Communicate information and ideas effectively to multiple audiences using a variety of media and formats (*Smartboard, overhead projector, etc*.)

NETS.S.4.A,B,C & D - Critical Thinking, Problem Solving, and Decision Making

Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.

a. Identify and define authentic problems and significant questions for investigation
b. Plan and manage activities to develop a solution or complete a project
c. Collect and analyze data to identify solutions and/or make informed decisions
d. Use multiple processes and diverse perspectives to explore alternative solutions

K-U-D

KNOW *Facts, formulas, information, vocabulary*	**DO** *Skills of the discipline, social skills, production skills, processes (usually verbs/verb phrases)*
• Multiplication and division notation • Equation format • Arrays • A letter can be used to stand for an unknown quantity • "X" means groups of • Repeated addition • Skip-counting • Division problems can be solved by thinking of them as unknown factor problems • Multiplication and division are inverse operations • Multiplication strategies (such as: using pictures, arrays, number line, repeated addition, etc.) • Drawings of equal groups • Area models • Fact families (Only when given the numbers to work with, not solving on their own) • 100 charts, multiplication charts **Vocabulary:** Factor, product, multiple, quotient, divisor, dividend, unknown factor, equal shares, patterns, repeated addition, repeated subtraction, skip counting, whole number, partition, fact families, number sentence, addends, equal groups, symbols, each, operation, array, rows, columns	• Identify numerical patterns related to operations to solve problems and/ or show thinking • Understand that the "X" means groups of. • Understand how to interpret products of whole numbers • Understand how to interpret whole number quotients • Identify patterns and explain them using properties of operation • Solve a problem using an appropriate strategy when given the equation **(Students should have the correct representation but do not need to know end the overall answer. Focus is on the understanding and process)**

Elementary Math Curriculum

Core Content and Practice Standards	Explanations and Examples*

UNDERSTAND

Big ideas, generalizations, principles, concepts, ideas that transfer across situations

- Students will understand how to represent multiplication and division using various strategies.
- Students will understand that the properties of operations helps us to develop efficient strategies to multiply and divide **(students do not need to know the names of these operations).**
- Students will understand that patterns help us to understand operations.

Academic Vocabulary

Factor, product, multiple, quotient, divisor, dividend, unknown factor, equal shares, patterns, repeated addition, repeated subtraction, skip counting, whole number, partition, fact families, number sentence, addends, equal groups, symbols, each, operation, array, rows, columns

Interdisciplinary Connections

Literacy connections (see books above).
a) Students can create own story problems based on the book. Classmates can try to solve each other's problems.
Real World application
a) Pose multiplication and division problems involving shopping, sharing a bill, etc.
Science (during life science unit)
a) Graph plant growth using centimeter cubes and tools for standard measurement. Graphing and comparing plant growth over a period of time.

Tools/Manipulatives

Apps for classroom use on iPad:

Ace Multiply Matrix

Multiplication Genius Lite

Multiplication Tables


Chalkboard Multiplication

Portable Math Multiplication


Math Tappers: Multiples


Kiddie Animated Multiplication

Division for Kids

Division Squeebles

Division

Other Tools

Tiles, multiplication mats, array models, fact family triangles, number lines for skip counting, hundreds chart for patterning, two sided counters and grid paper to make arrays, dice, spinners, deck of cards, calculator, base ten blocks, multiplication/division bingo cards, multiplication chart

Work Cited

Van de Walle, J., & Lovin, L. H. (2006). *Teaching student-centered mathematics, grades 3-5*. New York, NY: Allyn & Bacon.

Elementary Math Curriculum

Grade/Subject	Grade 3/ Mathematics
Unit Title	Unit 3 - Connecting and Using Multiplication and Division
Overview of Unit	This unit involves solving multiplication and division word problems including unknown numbers, applying properties of operations as strategies to multiply and divide, exploring the inverse relationship between multiplication and division and the use of this relationship to complete equations. Students will begin to explore the area model or the connected array to deepen their level of understanding of multiplication.
Pacing	**25 days** (plus **5 days** for reteaching/enrichment)

Core Content and Practice Standards	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)**
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 = ?. **Connections: 3.AO.3; 3.RI.3; 3.SL.1; ET03-S1C4-01**	**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.**
3.OA.5. Apply properties of operations as strategies to multiply and divide.[2] *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.)* **[2] Students need not use formal terms for these properties.**	**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.**
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.*	**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.**
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.	**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** • **Rachel has 3 bags. There are 4 marbles in each bag. How many marbles does Rachel have altogether? 3 x 4 = m** **Students may use interactive whiteboards to create digital models to explain and justify their thinking.** **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.

is the same quantity as 

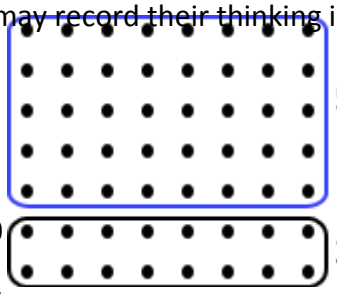
Example: 4 x 3 = 3 x 4

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

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

7 x 4 = 28

7 x 4 = 28

56

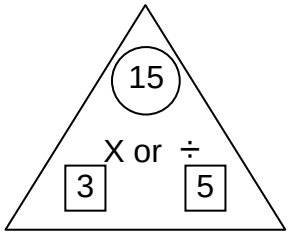
3.OA.8. Solve two-step word problems using the four operations. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding. (This standard is limited to problems posed 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).

Connections: *3.OA.4*; *3.OA.5*; *3.OA.6*; *3.OA.7*; *3.RI.7*

3.OA.6 Multiplication and division 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. 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

BOTH THE FOLLOWING STANDARDS ARE ALSO ADDRESSED IN NEXT UNIT!

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.

Connections: *3.RI.4*; *3.RI.7*; *ET03-S1C1-01*

3.MD.7. Relate area to the operations of multiplication and 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.

c. Use tiling to show in a concrete case that the area of a rectangle with whole-number side lengths a and $b + c$ is the sum of $a \times b$ and $a \times c$. Use area models to represent the distributive property in mathematical reasoning.

d. Recognize area as additive. Find areas of rectilinear figures by decomposing them into non-overlapping rectangles and adding the areas of the non-overlapping parts, applying this technique to solve real world problems.

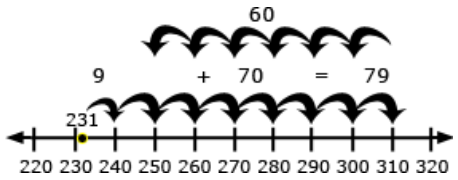
three times (8s)
- Tens facts (relating to place value, 5 x 10 is 5 tens or 50)
- Five facts (half of tens)
- Skip counting (counting groups of __ and knowing how many groups have been counted)
- Square numbers (ex: 3 x 3)
- Nines (10 groups less one group, e.g., 9 x 3 is 10 groups of 3 minus one group 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

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 = m and uses rounding
  - (230 + 80 – 60) to estimate.
  - A student writes the equation, 231 + 79 – 60 = m and calculates 79-60 = 19 and then calculates 231 + 19 = m.

Practice Standards

Practices in bold are to be emphasized in the unit.

1. Make sense of problems and persevere in solving them.

2. Reason abstractly and quantitatively.

3. Construct viable arguments and critique the reasoning of others.

4. Model with mathematics.

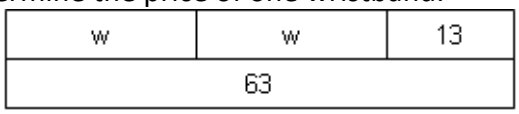
5. Use appropriate tools strategically.

6. Attend to precision.

7. Look for and make use of structure.

8. Look for and express regularity in repeated reasoning.

- 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.

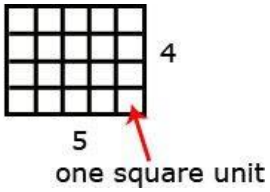
When students solve word problems, they use various estimation skills which include identifying when estimation is appropriate, determining the level of accuracy needed, selecting the appropriate method of estimation, and verifying solutions or determining the reasonableness of solutions.

- 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.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.

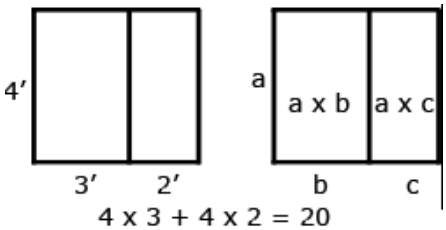


3.MD.7 Students tile areas of rectangles, determine the area, record the length and width of the rectangle, investigate the patterns in the numbers, and discover that the area is the length times the width.

Examples:

- 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?

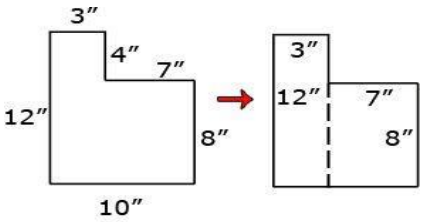
  Students use pictures, words, and numbers to explain their understanding of the distributive property in this context.



$4 \times 3 + 4 \times 2 = 20$

$4 (3 + 2) = 20$

$4 \times 5 = 20$

	• 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

ISTE Standards

NETS.S.4.A,B,C & D - Critical Thinking, Problem Solving, and Decision Making

Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.

a. Identify and define authentic problems and significant questions for investigation
b. Plan and manage activities to develop a solution or complete a project
c. Collect and analyze data to identify solutions and/or make informed decisions
d. Use multiple processes and diverse perspectives to explore alternative solutions

K-U-D

KNOW *Facts, formulas, information, vocabulary*	**DO** *Skills of the discipline, social skills, production skills, processes (usually verbs/verb phrases)*
• Multiplication and division notation • A letter can be used to stand for an unknown quantity • Division problems can be solved by thinking of them as unknown factor problems • Multiplication and division are inverse operations • Contextual Story Problems • Properties of Operations Vocabulary: factor, product, multiple, quotient, divisor, dividend, rows, columns, algorithm, unknown factor, equal shares, algebraic equation, associative, commutative, fact families, arrays, equal groups, fair shares, number sentence, property, operation, patterns, parentheses, distributive, symbol, composing numbers, decomposing number, repeated addition, grouping, skip-counting, array, multiplication facts, repeated subtraction, area	• Identify numerical patterns related to operations to solve problems and/ or show thinking • Understand that the "X" means groups of • Determine the unknown in multiplication and division story problems • Identify patterns and explain them using properties of operation • Solve a contextual story problem using an appropriate strategy when given the equation • Explain thinking, using at least one example, to verify that an answer is reasonable. • Understand how an area model or array can be used to show a representation of multiplication

UNDERSTAND *Big ideas, generalizations, principles, concepts, ideas that transfer across situations*
• Students will understand that multiplication and division can be used to find an unknown number. • Students will understand that the properties of operations helps us to develop efficient strategies to multiply and divide **(students do not need to know the names of these operations).** • Students will understand that multiplication and division are inverse operations. • Students will understand that an area model or array represent multiplication.

Academic Vocabulary
Factor, product, multiple, quotient, divisor, dividend, rows, columns, algorithm, unknown factor, equal shares, algebraic equation, associative, commutative, fact families, arrays, equal groups, fair shares, number sentence, property, operation, patterns, parentheses, distributive, symbol

Interdisciplinary Connections
Literacy connections (see books above). a) Students can create story problems based on the book. Classmates can try to solve each other's problems. b) Math Read aloud task cards involving literature: http://www.k-5mathteachingresources.com/3rd-grade-number-activities.html Real World application a) Pose multiplication and division problems involving shopping, sharing a bill, etc.

Tools/Manipulatives

Apps for classroom use on iPad:

Ace Multiply Matrix

Multiplication Genius Lite

Multiplication Tables

Chalkboard Multiplication

Portable Math Multiplication

Math Tappers: Multiples

Kiddie Animated Multiplication

Division for Kids

Division Squeebles

Division

Other Tools

Tiles, multiplication mats, array models, fact family triangles, number lines for skip counting, hundreds chart for patterning, two sided counters, grid paper to make arrays, dice, spinners, deck of cards, calculator, base ten blocks, multiplication/division bingo cards, multiplication chart

Suggested Formative Assessment Practices/Processes

- Timed multiplication/division quizzes- 20 problems/per minute (fact families that students have learned)
- Formative assessments from math program (if applicable)
- Teacher created story problems involving multiplication and division for students to solve.

Work Cited

Van de Walle, J., & Lovin, L. H. (2006). *Teaching student-centered mathematics, grades 3-5*. New York, NY: Allyn & Bacon.

Elementary Math Curriculum

Grade/Subject	Grade 3/ Mathematics
Unit Title	Unit 4 – Applying all Four Operations to Problem Solve
Overview of Unit	This unit is about helping students connect different meanings and relationships to the four operations of addition, subtraction, multiplication, and division so that they can accurately and fluently apply these operations in real-world settings. It is important for students to develop an concrete understanding of operational sense, a highly integrated understanding of the four operations and the many different but related meanings these operations take on in real contexts (Van de Walle)
Pacing	**20 days** (plus **5 days** for reteaching/enrichment)

Academic Vocabulary
Properties of operations (commutative property, associative property, distributive property), skip counting, two-step problems, equations, unknown quantity, estimation, mental computation, order of operation, rounding, patterns, place value, algorithms based on place value, products of 2 one-digit numbers
Interdisciplinary Connections
Literacy connections (see books above). a) Students can create story problems based on the book. Classmates can try to solve each other's problems. b) Math Read aloud task cards involving literature: http://www.k-5mathteachingresources.com/3rd-grade-number-activities.html Real World application a) Pose multiplication and division problems involving shopping, sharing a bill, etc.
Tools/Manipulatives
Apps for classroom use on iPad:  Ace Multiply Matrix  Multiplication Genius Lite  Multiplication Tables  Chalkboard Multiplication  Portable Math Multiplication  Math Tappers: Multiples  Kiddie Animated Multiplication  Division for Kids  Division Squeebles  Long Division Tools: An important model to use in third grade is the hundreds chart.

Other Tools

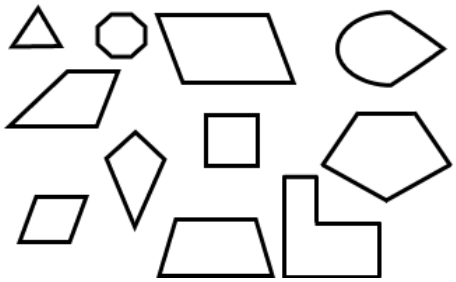
Tiles, multiplication mats, array models, fact family triangles, number lines for skip counting, hundreds chart for patterning, two sided counters, grid paper to make arrays, dice, spinners, deck of cards, calculator, base ten blocks, multiplication/division bingo cards, multiplication chart

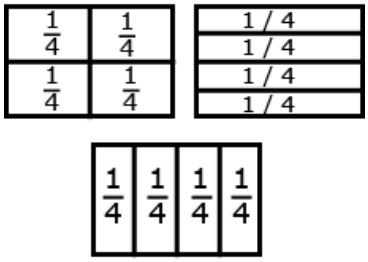
Work Cited

Van de Walle, J., & Lovin, L. H. (2006). *Teaching student-centered mathematics, grades 3-5*. New York, NY: Allyn & Bacon.

Elementary Math Curriculum

Grade/Subject	Grade 3/Mathematics
Unit Title	Unit 5/ Reasoning About 2D Shapes
Overview of Unit	This unit focuses on the understanding that shapes in are in different categories (e.g., rhombuses, rectangles, and others) may share attributes (e.g., having four sides), and that the shared attributes can define a larger category (e.g., quadrilaterals). Recognize rhombuses, rectangles, and squares as examples of quadrilaterals, and draw examples of quadrilaterals that do not belong to any of these subcategories. Students will also understand that shapes can be partitioned into equal size pieces.
Pacing	20 Days

Core Content Standards	Explanations and Examples **(Developed by Arizona DOE)**
3.G.1. Understand that shapes in different categories (e.g., rhombuses, rectangles, and others) may share attributes (e.g., having four sides), and that the shared attributes can define a larger category (e.g., quadrilaterals). Recognize rhombuses, rectangles, and squares as examples of quadrilaterals, and draw examples of quadrilaterals that do not belong to any of these subcategories.	3.G.1 In third grade, students identify and draw triangles, quadrilaterals, pentagons, and hexagons. Third graders build on this experience and further investigate quadrilaterals (technology may be used during this exploration). Students recognize shapes that are and are not quadrilaterals by examining the properties of the geometric figures. They conceptualize that a quadrilateral must be a closed figure with four straight sides and begin to notice characteristics of the angles and the relationship between opposite sides. Students should be encouraged to provide details and use proper vocabulary when describing the properties of quadrilaterals. They sort geometric figures (see examples below) and identify squares, rectangles, and rhombuses as quadrilaterals. 

3.G.2. Partition shapes into parts with equal areas. Express the area of each part as a unit fraction of the whole. *For example, partition a shape into 4 parts with equal area, and describe the area of each part as 1/4 of the area of the shape.*	3.G.2 Given a shape, students partition it into equal parts, recognizing that these parts all have the same area. They identify the fractional name of each part and are able to partition a shape into parts with equal areas in several different ways. 
Standards for Mathematical Practice	
1. Make sense of problems and persevere in solving them 2. Reason abstractly and quantitatively 3. Construct viable arguments and critique the reasoning of others 4. Model with mathematics 5. Use appropriate tools strategically 6. Attend to precision 7. Look for and make use of structure 8. Look for and express regularity in repeated reasoning	

ISTE Standards
http://www.iste.org/standards/nets-for-students.aspx) 2. **Creativity** 3. **Communication and Collaboration** 4. **Research and Information Fluency** 5. **Critical Thinking, Problem Solving, and Decision Making** 6. **Digital Citizenship** 7. **Technology Operations and Concepts**

Elementary Math Curriculum

K-U-D

KNOW *Facts, formulas, information, vocabulary*	DO *Skills of the discipline, social skills, production skills, processes (usually verbs/verb phrases)* *Hint: Use the standards!*
Vocabulary: ● Rhombuses ● Rectangles ● Plane shape ● Squares ● Quadrilaterals ● Triangles ● Dimension- 2 dimensional ● Line/Line segments ● Curves ● Sides ● Polygon ● Closed figure/open figure ● Attributes ● Angles ● Vertex ● Parallelogram ● Hexagon ● Pentagon ● Circle ● Trapezoid	● Understand different categories of shapes ○ Understand that shapes in different categories may share attributes ● Recognize/identify rhombuses (squares), rectangles, and squares as quadrilaterals ● Draw examples of quadrilaterals ● Draw examples of quadrilaterals that do not fit in a subcategory ● Partition shapes into equal parts with equal area ● Express area of each part as a unit fraction of a whole (½, ¼, etc) ● Sort and explain shapes according to their attributes ● Compare shapes based on similar/ and or varying attributes

UNDERSTAND *Big ideas, generalizations, principles, concepts, ideas that transfer across situations*
Students will understand that shapes in different categories may share attributes and that the shared attributes can define a larger category. **Students will understand that** shapes can be partitioned into equal parts of a whole.

Unit Assessment/Performance Task	DOK
In this performance task, students will create a garden design with specific criteria. This criterion will include 2D shapes as well as partitioning of shapes.	

Vocabulary

- Rhombuses
- Rectangles
- Plane shape
- Squares
- Quadrilaterals
- Triangles
- Dimension- 2 dimensional
- Line/Line segments
- Curves
- Sides
- Polygon
- Closed figure/open figure
- Attributes
- Angles
- Vertex
- Parallelogram
- Hexagon
- Pentagon
- Circle
- Trapezoid

Interdisciplinary Connections

Science: Rocks and Minerals Unit, focus in on shapes of rocks and minerals

Suggested Formative Assessments/ Processes

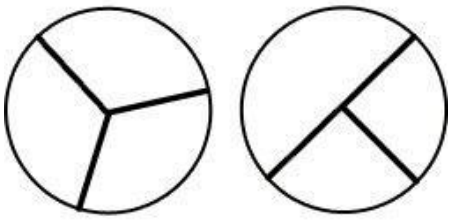
The Recording Sheet is a graphic organizer that can help you understand what students know about two-dimensional shapes. Other formative assessment questions might include:
Exit Slips:
• What are some differences between the shapes listed?
• Are any of the shapes alike?
• Can you give me an example of a (name a shape?) What about a non-example?
• Are all of these shapes the same?

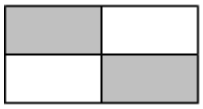
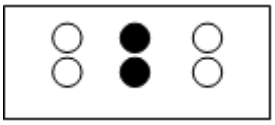
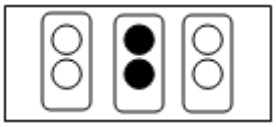
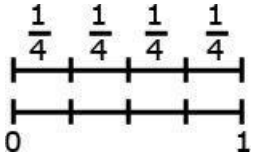
Work Cited

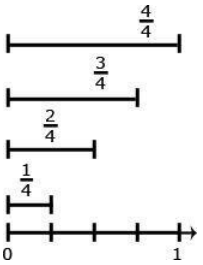
Van de Walle, J., & Lovin, L. H. (2006). *Teaching student-centered mathematics, grades 3-5*. New York, NY: Allyn & Bacon.

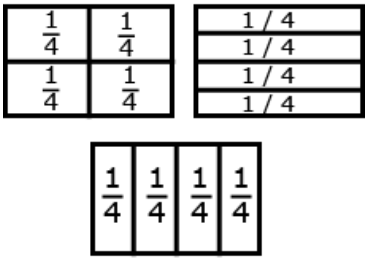
Elementary Math Curriculum

Grade/Subject	Grade 3/ Mathematics
Unit Title	Unit 6/ Understanding and Reasoning about Fractions
Overview of Unit	The conceptual focus of this unit is to provide students with the ability to explore fraction concepts. This is the first year students will have in depth understanding of fractions. Students will understand how fractions are formed, what a fraction stands for, representing fractions on a number line, identifying and comparing equivalent fractions and portioning shapes into fractions or equal parts.
Pacing	40 Days

Core Content Standards	**Explanations and Examples** (Developed by Arizona DOE)
3.NF.A.1 Understand a fraction 1/*b* as the quantity formed by 1 part when a whole is partitioned into *b* equal parts; understand a fraction *a*/*b* as the quantity formed by *a* parts of size 1/*b*.	Some important concepts related to developing understanding of fractions include: • Understand fractional parts must be equal-sized Example: Non-example:  These are thirds. These are NOT thirds. • The number of equal parts tell how many make a whole • As the number of equal pieces in the whole increases, the size of the fractional pieces decreases • The size of the fractional part is relative to the whole o The number of children in one-half of a classroom is different than the number of children in one-half of a school. (the whole in each set is different therefore the half in each set will be different) • When a whole is cut into equal parts, the denominator represents the number of equal parts • The numerator of a fraction is the count of the number of equal parts o ¾ means that there are 3 one-fourths o Students can count *one fourth, two fourths, three fourths* Students express fractions as fair sharing, parts of a whole, and parts of a set. They use various contexts (candy bars, fruit, and cakes) and a variety of models (circles, squares, rectangles,

Core Content Standards	Explanations and Examples (Developed by Arizona DOE)
	fraction bars, and number lines) to develop understanding of fractions and represent fractions. Students need many opportunities to solve word problems that require fair sharing. To develop understanding of fair shares, students first participate in situations where the number of objects is greater than the number of children and then progress into situations where the number of objects is less than the number of children. **Examples**: • Four children share six brownies so that each child receives a fair share. How many brownies will each child receive? • Six children share four brownies so that each child receives a fair share. What portion of each brownie will each child receive? • What fraction of the rectangle is shaded? How might you draw the rectangle in another way but with the same fraction shaded?  Solution: $\frac{2}{4}$ or $\frac{1}{2}$ • What fraction of the set is black?  Solution: $\frac{2}{6}$  Solution: $\frac{1}{3}$
3.NF.A.2 Understand a fraction as a number on the number line; represent fractions on a number line diagram.	Students transfer their understanding of parts of a whole to partition a number line into equal parts. There are two new concepts addressed in this standard which students should have time to develop. 1. On a number line from 0 to 1, students can partition (divide) it into equal parts and recognize that each segmented part represents the same length. 

Core Content Standards	Explanations and Examples (Developed by Arizona DOE)
3.NF.A.2.A Represent a fraction 1/*b* on a number line diagram by defining the interval from 0 to 1 as the whole and partitioning it into *b* equal parts. Recognize that each part has size 1/*b* and that the endpoint of the part based at 0 locates the number 1/*b* on the number line. **3.NF.A.2.B** Represent a fraction *a*/*b* on a number line diagram by marking off a lengths 1/*b* from 0. Recognize that the resulting interval has size *a*/*b* and that its endpoint locates the number *a*/*b* on the number line.	2. Students label each fractional part based on how far it is from zero to the endpoint.  An interactive whiteboard may be used to help students develop these concepts.
3.NF.A.3 Explain equivalence of fractions in special cases, and compare fractions by reasoning about their size. **3.NF.A.3.A** Understand two fractions as equivalent (equal) if they are the same size, or the same point on a number line. **3.NF.A.3.B** Recognize and generate simple equivalent fractions, e.g., 1/2 = 2/4, 4/6 = 2/3. Explain why the fractions	An important concept when comparing fractions is to look at the size of the parts and the number of the parts. • For example, $\frac{1}{8}$ is smaller than $\frac{1}{2}$ because when 1 whole is cut into 8 pieces, the pieces are much smaller than when 1 whole is cut into 2 pieces. Students recognize when examining fractions with common denominators, the wholes have been divided into the same number of equal parts. So the fraction with the larger numerator has the larger number of equal parts. $\frac{2}{6} < \frac{5}{6}$ To compare fractions that have the same numerator but different denominators, students understand that each fraction

Core Content Standards	Explanations and Examples (Developed by Arizona DOE)
are equivalent, e.g., by using a visual fraction model. **3.NF.A.3.C** Express whole numbers as fractions, and recognize fractions that are equivalent to whole numbers. *Examples: Express 3 in the form 3 = 3/1; recognize that 6/1 = 6; locate 4/4 and 1 at the same point of a number line diagram*. **3.NF.A.3.D** Compare two fractions with the same numerator or the same denominator by reasoning about their size. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with the symbols >, =, or <, and justify the conclusions, e.g., by using a visual fraction model.	has the same number of equal parts but the size of the parts are different. They can infer that the same number of smaller pieces is less than the same number of bigger pieces. $\frac{3}{8} < \frac{3}{4}$
3.G.A.2. Partition shapes into parts with equal areas. Express the area of each part as a unit fraction of the whole. For example, partition a shape into 4 parts with equal area, and describe the area of each part as 1/4 of the area of the shape.	Given a shape, students partition it into equal parts, recognizing that these parts all have the same area. They identify the fractional name of each part and are able to partition a shape into parts with equal areas in several different ways. 

Core Content Standards	Explanations and Examples (Developed by Arizona DOE)
Standards for Mathematical Practice	**Explanations and Examples**
9. Make sense of problems and persevere in solving them 10. Reason abstractly and quantitatively 11. Construct viable arguments and critique the reasoning of others 12. Model with mathematics 13. Use appropriate tools strategically 14. Attend to precision 15. Look for and make use of structure 16. Look for and express regularity in repeated reasoning	
ISTE Standards	
(http://www.iste.org/standards/nets-for-students.aspx) *After reading their descriptions, DELETE those that do not apply to this unit of study and indicate the substandard(s) that do apply to the unit.* 8. **Creativity** **4. Critical Thinking, Problem Solving, and Decision Making**	**nets.s.1.a** Apply existing knowledge to generate new ideas, products, or processes **nets.s.1.c** Use models and simulations to explore complex systems and issues **nets.s.4.a** Identify and define authentic problems and significant questions for investigation **nets.s.4.b** Plan and manage activities to develop a solution or complete a project
K-U-D	
KNOW *Facts, formulas, information, vocabulary*	**DO** *Skills of the discipline, social skills, production skills, processes (usually verbs/verb phrases)* *Hint: Use the standards!*
• numerator	• read fractions

Core Content Standards	Explanations and Examples (Developed by Arizona DOE)
• denominator • fraction • fraction bar • half/halves • third • fourth • sixth • eighth • equal parts • partition • number line • equivalent fractions • whole number • compare • greater than> • less than< • equal to = • quantity • part • whole • equal	• explain that fractional parts must be equal size • understand how fractions are formed • partition shapes into equal parts • recognize fractions • express area of each part as a fraction of the whole • partition a number line into equal sized parts • identify fractions on a number line • identify space/line between zero and one on a number line as a whole • compare two fractions • record results of the comparisons using appropriate symbols (< > +=) • justify results of comparisons by size • recognize equivalent fractions • justify and explain how fractions are equivalent • generate equivalent fractions • use visuals to show equivalent fractions • recognize part of a set

UNDERSTAND

Big ideas, generalizations, principles, concepts, ideas that transfer across situations

- Students will understand **that** when partitioning a whole into more equal shares, the parts become smaller.
- Students will understand **that** fractional parts are equal shares or parts of a whole unit.
- Students will understand **that** partitioned shapes must be equal in size.
- Students will understand **that** fractions are numbers with special names that tell how many parts of that size are needed to make the whole.
- Students will understand **that** a fraction has a numerator and a denominator.
- Students will understand **that** two fractions are equivalent when they are two different ways of describing the same amount by using different sized fractional parts.
- Students will understand **that** fractions can be compared based on their size.
- Students will understand **that** comparisons are valid only when two fractions refer to the same whole.
- Students will understand **that** ¾ is the same as 3 hops of ¼ on the number line (Ex: 3 of the ¼ = ¾).
- Students will understand **that** each space on the number line represent the same interval.
- Students will understand **that** each interval on a number line can be broken up into equal shares.
- Students will understand **that** if the denominators are the same they can compare the numerators like whole numbers.

Vocabulary
Academic Vocabulary Whole Number line **Domain-Specific Vocabulary** Fraction Equal parts Numerator Denominator **Unit-Specific Vocabulary-** See KUD Above
Tools/Manipulatives
I pad Apps: *http://igamemom.com/2013/06/03/free-app-learn-fraction-comparison-with-visual-help/* Manipulatives: Number lines, fraction bars, tiles, cubes, dice

Suggested Formative Assessment Practices/Processes
1. *Students use a geoboard and colored rubber bands. They use one color to create a square. Students use a different color to divide the square into factional parts. 1/2, 1/4, 1/8.* 2. *Use tape to make a number line. Distribute sticky notes with fractions. Have the students come up and put their fraction on the number line where it belongs.* 3. *Have students turn and talk to discuss the following:* *How can fraction bars or circles help to find equivalent fractions?* *How are equivalent fractions on a number line similar to equivalent fraction circles?* 4. *Give 2 different fractions and have students write on white boards and use < > = to show comparison*.

Work Cited

Van de Walle, J., & Lovin, L. H. (2006). *Teaching student-centered mathematics, grades 3-5*. New York, NY: Allyn & Bacon.

Mentoring Minds, Motivation Math, Level 3 (2012-2013). Tyler, TX: Jujan, M.L.

Elementary Math Curriculum

Grade/Subject	Grade 3/ Mathematics
Unit Title	Unit 7 – Measurement and Data
Overview of Unit	In this unit students will begin solving problems involving elapsed time using models and manipulatives. Students will study standard measurement of liquid volumes and mass to solve 1 step word problems. Students will read picture and bar graphs and solve problems with data presented on the graphs. Students will draw simple bar and picture graphs with several categories. Students will use the four operations to solve one- and two-step problems.
Pacing	**20 days** (plus **5 days** for reteaching/enrichment)

Core Content and Practice Standards	Explanations and Examples*
3.MD.1 Tell and write time to the nearest minute and measure time intervals in minutes. Solve word problems involving addition and subtraction of time intervals in minutes by representing the problems on a number line diagram.	**3.MD.1** Students in second grade learned to tell time to the nearest five minutes. In third grade, they extend telling time and measure elapsed time both in and out of context using clocks and number lines. Students may use an interactive whiteboard to demonstratee understanding and justify their thinking.
3.MD.2 Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms(kg), and liters (l). (excludes compound units such as cm3 and finding the geometric volume of a container.) Add, subtract, multiply, or divide to solve one-step word problems involving masses or volumes that are given in the same units by using drawings (such as a beaker with a measurement scale) to represent the problem. Excludes multiplicative comparison problems (problem involving notions of "times as much"; Table 2)	**3.MD.2** Students need multiple opportunities weighing classroom objects and filling containers to help them develop a basic understanding of the size and weight of a liter, a gram, and a kilogram. Millimeters may also be used to show amounts that are less than a liter. Example: Students identify 5 things that weigh about one gram. They record their findings with words and pictures. (Students can repeat this for 5 grams and 10 grams). This activity helps develop gram benchmarks. One large paperclip weighs about one gram. A box of large paperclips (100 clips) weighs about 100 grams so 10 boxes would weigh about one kilogram.

Core Content and Practice Standards	Explanations and Examples*
3.MD.3 Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one and two step "how many more" and "how many less" problems using information presented in the scaled bar graph. For example, draw a bar graph in which each square in the bar graph might represent 5 pets. **3.MD.4** Generate measurement data by measuring lengths using ruler marked with halves and fourths of an inch. Show the data by marking a line plot, where the horizontal scale is marked off in appropriate units- whole number, halves, or quarters. **Math Practice Standards:** **1. Make sense of problems and persevere in solving them.** **2. Reason abstractly and quantitatively.** 3. Construct viable arguments and critique the reasoning of others. **4. Model with mathematics.** 5. Use appropriate tools strategically. 6. Attend to precision. **7. Look for and make use of structure.** **8. Look for and express regularity in repeated reasoning.**	**3.MD.3** Students should have opportunities reading and solving problems using scaled graphs before being asked to draw one. The following graphs all use five as the scale interval, but students should experience different intervals to further develop their understanding of scale graphs and number facts. - Pictographs: Scaled pictographs include symbols that represent multiple units. Below is an example of a pictograph with symbols that represent multiple units. Graphs should include a title, categories, category label, key, and data. -Single Bar Graphs: Students use both horizontal and vertical bar graphs. Bar graphs include a title, scale, scale label, categories, category label, and data. **3.MD.4** Students in second grade measured length in whole units using both metric and U.S. customary systems. It's important to review with students how to read and use a standard ruler including details about halves and quarter marks on the ruler. Students should connect their understanding of fractions to measuring to one- quarter inch and one- half inch. Third graders need many opportunities measuring the length of various objects in their environment. Some important ideas related to measuring with a ruler are: - The starting point of where one places a ruler to begin measuring. - Measuring is approximate. Items that students measure will not always measure exactly ¼, ½, or one whole inch. Students will need to decide on an appropriate estimate length. - Marking paper rulers and folding to find the half and quarter marks will help students develop a stronger understanding of measuring length.

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ISTE Standards

NETS.S.1.C - Creativity and Innovation
Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology.

c. Use models and simulations to explore complex systems and issues

NETS.S.2.B - Communication and Collaboration
Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.

b. Communicate information and ideas effectively to multiple audiences using a variety of media and formats

NETS.S.4.A,B,C & D - Critical Thinking, Problem Solving, and Decision Making
Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.

a. Identify and define authentic problems and significant questions for investigation
b. Plan and manage activities to develop a solution or complete a project
c. Collect and analyze data to identify solutions and/or make informed decisions
d. Use multiple processes and diverse perspectives to explore alternative solutions

K-U-D

KNOW *Facts, formulas, information, vocabulary*	**DO** *Skills of the discipline, social skills, production skills, processes (usually verbs/verb phrases)*
Units of measurement: - Inch - Foot - Yards - Centimeter - Meter - Grams - Kilograms - Liters - Hours - Minute Vocabulary: Units of measurement (see above), length, tools, ruler, yardstick, tape measure, meter stick, standard unit, us/customary, metric, estimate, approximate, measure, compare, difference, volume, mass, capacity, halves, fourths, quarter, analog clock, digital clock, elapsed time, bar graph, picture graph, line plot, data, horizontal, vertical, titles, categories, key, scale, axis (x, y), vertex, face, corner Strategies: ● Decide which unit of measurement is appropriate to use with a given object ● Measure to the nearest whole, half, and quarter unit using metric and customary	**Time** ● Tell time to the nearest minute ● Write time to the nearest minute o in analog form o in digital form ● Measure elapsed time using clocks and number lines **Measurement** ● Generate measurement data ● Create line plot to compare measured items' lengths o Use rulers to measure lengths to halves and fourths ● Measure and estimate liquid volumes and masses using standard units (grams, kilograms and liters) ● Estimate the mass of objects using everyday items from around the classroom ● Use words and pictures to show mass and volume ● Solve word problems involving masses and volumes **Graphing** ● Read & solve one and two step problems using

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Core Content and Practice Standards	Explanations and Examples*
● Estimate the length of object ● Use drawings to represent word problems for volume and mass	graphs ● Draw scaled picture and bar graphs to represent data ● Label all parts of graphs students create ● Use a key in a picture graph when it represents multiple units

UNDERSTAND

Big ideas, generalizations, principles, concepts, ideas that transfer across situations

Time

- Students will understand that time is measurable in minutes and hours
- Students will understand that time can be expressed in multiple ways

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Measurement

- Students will understand that there are multiple tools that can be used to measure objects
- Students will understand that there is a connection between fractions and measurement
- Students will understand that a line plot can be used to compare measurement
- Students will understand that the concept of measurement extends beyond length and includes capacity, weight and time
- Students will understand that when comparing objects, nonstandard units can be used (Ex: 10 paperclips is the same length as the book)
- Students will understand that there is a relationship between different units of measurement (1 foot = 12 inches)

Graphing

- Students will understand that graphs can be used as a visual representation of data
- Students will understand that there are multiple parts to every graph
- Students will understand that there are multiples graphs that can be used to represent data

Academic Vocabulary
a.m. **analog clock** **digital clock** **elapsed time** **half hour** **hour** **hour hand** **minute** **minute hand** **o'clock** **p.p.** **quarter hour** **time** **time interval** **capacity** **gram** **kilogram** **liquid volume** **liter** **mass** **milliliter** **standard units** **bar graph** **data** **key** **picture graph** **scale** **data** **half inch** **inch** **line plot** **quarter inch** **tally chart**

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Tools/Manipulatives
Apps for classroom use on iPad:  Ace Multiply Matrix  Multiplication Genius Lite  Multiplication Tables  Chalkboard Multiplication  Portable Math Multiplication  Math Tappers: Multiples  Kiddie Animated Multiplication  Division for Kids  Division Squeebles  Long Division

Suggested Formative Assessment Practices/Processes
Exit Slips

Work Cited

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