Grade 3 Unit 2: Concepts of Area and Place Value Properties for Multi-Digit Arithmetic

Content Area: **Math**
Course(s): **Math Grade 3**
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NJSLS Math

MATH.3.OA.A.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.
MATH.3.OA.A.4	Determine the unknown whole number in a multiplication or division equation relating three whole numbers.
MATH.3.OA.B.5	Apply properties of operations as strategies to multiply and divide.
MATH.3.OA.C.7	With accuracy and efficiency, multiply and divide within 100, using strategies such as the relationship between multiplication and division (e.g., knowing that 8 × 5 = 40, one knows 40 ÷ 5 = 8) or properties of operations. By the end of Grade 3, know from memory all products of two one-digit numbers.
MATH.3.OA.D.8	Solve two-step word problems, including problems involving money, 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.
MATH.3.OA.D.9	Identify arithmetic patterns (including patterns in the addition table or multiplication table) and explain them using properties of operations.
MATH.3.NBT.A.1	Use place value understanding to round whole numbers to the nearest 10 or 100.
MATH.3.NBT.A.2	With accuracy and efficiency, add and subtract within 1000 using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction.
MATH.3.NBT.A.3	Multiply one-digit whole numbers by multiples of 10 in the range 10–90 (e.g., 9 × 80, 5 × 60) using strategies based on place value and properties of operations.
MATH.3.M.B.3	Recognize area as an attribute of plane figures and understand concepts of area measurement.
MATH.3.M.B.3.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.
MATH.3.M.B.3.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.
MATH.3.M.B.4	Measure areas by counting unit squares (square cm, square m, square in, square ft, and non-standard units).
MATH.3.M.B.5	Relate area to the operations of multiplication and addition.
MATH.3.M.B.5.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.
MATH.3.M.B.5.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.
MATH.3.M.B.5.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.
MATH.3.M.B.5.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.
MATH.3.DL.B.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 scaled bar graphs.

Unit Focus

- Geometric Measurement: understand concepts of area and relate area to multiplication and addition.
- Represent and interpret data.
- Use place value understanding and properties of operations to perform multi-digit arithmetic.

Standards for Math Practice

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.K-12.8	Look for and express regularity in repeated reasoning.

Critical Knowledge & Skills

NJSLS Math	Suggested Math Practices	Critical Knowledge and Skills
3.M.B.3a-b (**M**) 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.	MP.2 Reason abstractly and quantitatively. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically.	Concepts: • Area is the amount of space inside the boundary of a (closed) figure. • 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. • Plane figure which can be

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.	MP.7 Look for and make use of structure.	covered without gaps or overlaps by n unit squares is said to have an area of n square units • Area can be found by covering a figure with unit squares. • Area of a figure can be determined using unit squares of other dimensions. Students will be able to: • Define a unit square and its purpose in measuring area. • Apply the concept of unit squares to calculate the area of simple plane figures. Learning Goal 1: • Apply the concept of unit squares to calculate the area of simple plane figures.
3.M.B.4 (**M**) Measure areas by counting unit squares (square cm, square m, square in, square ft, and non-standard units).	MP.2 Reason abstractly and quantitatively. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.7 Look for and make use of structure.	Concepts: • No new concepts introduced. Students will be able to: • Count unit squares in order to measure the area of a figure. • Use unit squares of centimeters, meters, inches, feet, and other units to measure area. Learning Goal 2: • Measure areas by counting unit squares (cm^2, m^2, in^2,

		ft^2, and improvised units).
3.M.B.5a-d (**M**) 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 and is the sum of and . 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.	MP.4 Model with mathematics. MP.5 Use appropriate tools strategically.	Concepts: • Area of a rectangle is found by multiplying the side lengths. • Area of a rectangle may be found by tiling. Students will be able to: • Tile a rectangle with unit squares. • Multiply side lengths of a rectangle to find its area and compare the result to that found by tiling the rectangle with unit squares. • Solve real world and mathematical problems involving measurement. • Represent a rectangular area as the product of whole-numbers. Learning Goal 3: • Tile a rectangle to find its area and explain the relationship between tiling and multiplying side lengths to find the area of rectangles; solve real world problems by multiplying side lengths to find areas of rectangles.
3.OA.A.4 (**M**) 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 x ?	MP.2 Reason abstractly and quantitatively. MP.7 Look for and make use of structure.	Concepts: • No new concepts introduced. Students will be able to:

= 48, 5 = ? ÷ 3, 6 x 6 = ?.		• Determine which operation is needed to find the unknown. • Multiply or divide, within 100, to find the unknown whole number in a multiplication or division equation. Learning Goal 4: • Determine the unknown in a division or multiplication equation relating 3 whole numbers (within 100).
3.OA.C.7 (**M**) With accuracy and efficiency, multiply and divide within 100, using strategies such as the relationship between multiplication and division (e.g., knowing that 8 x 5 = 40, one knows 40 ÷ 5 = 8) or properties of operations. By the end of Grade 3, know from memory all products of two one-digit numbers.	MP.2 Reason abstractly and quantitatively. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.	Concepts: • No new concept) introduced Students will be able to: • Multiply and divide within 50 with accuracy and efficiency. Learning Goal 5: • Fluently multiply and divide within 50 using strategies such as the relationship between multiplication and division.
3.DL.B.3 (**S**) 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 scaled bar graphs. For example, draw a bar graph in which each square in the bar graph might represent 5 pets.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.4 Model with mathematics.	Concepts: • Graphs organize information and contain labels. • Pictures and bars can represent numbers in graphs. • Different graphs may display different scales. Students will be able to:

		• Draw scaled picture graphs. • Draw scaled bar graphs. • Analyze, interpret and create bar graphs and pictographs in real world situations. • Solve “how many more” and “how many less” problems using scaled bar graphs. Learning Goal 6: • Create a scaled picture graph and a scaled bar graph accurately to represent a given data set. Interpret data presented in the graphs to answer questions related to "how many more" and "how many less."
3.OA.A.3 (**M**) 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.  Climate Change Example: Students may solve multiplication and division word problems involving measurement quantities related to glacier retreat.	MP.1 Make sense of problems and persevere in solving them. MP.4 Model with mathematics.	Concepts: • No new concepts introduced Students will be able to: • Multiply to solve word problems involving equal groups and arrays. • Divide to solve word problems involving equal groups and arrays. • Represent a word problem with a drawing showing equal groups, arrays, equal shares, and/or total objects. • Represent a word problem with an equation. Learning Goal 7:

		• Use multiplication and division within 100 to solve word problems by modeling equal groups or arrays and by writing equations to represent equal groups or arrays
3.OA.D.8 (**M**) Solve two-step word problems, including problems involving money, 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. (Clarification: 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) Climate Change Example: Students may use the four operations to solve two-step word problems related to glacier retreat.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics MP.5 Use appropriate tools strategically. MP.6 Attend to precision.	Concepts: • Letters or symbols in an equation represent an unknown quantity. Students are able to: • Represent the solution to two-step word problems with equations. • Use a symbol to represent an unknown in an equation. • Use rounding as an estimation strategy. • Explain, using an estimation strategy, whether an answer is reasonable. Learning Goal 8: • Write equations when solving two-step word problems, using a symbol for an unknown; find the value of an unknown in an equation involving any of the four operations and use estimation strategies to assess the reasonableness of answers.
3.NBT.A.2 (**A**) With accuracy and efficiency, add and subtract within 1000 using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction.	MP.2 Reason abstractly and quantitatively.	Concepts: • No new concepts introduced Students will be able to:

		• Add and subtract two 2-digit whole numbers within 500 with accuracy and efficiency. Learning Goal 9: • Fluently add and subtract (with regrouping) two 2-digit whole numbers within 500.
3.OA.D.9 (**M**) 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.	MP.3 Construct viable arguments and critique the reasoning of others. MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.	Concepts: • Addition and multiplication tables reveal arithmetic patterns. • Patterns may be related to whether a number is even or odd. • Patterns exist in rows, columns and diagonals of addition tables and multiplication tables. • Decomposing numbers into equal addends may reveal patterns. Students will be able to: • Explain arithmetic patterns using properties of operations. Learning Goal 10: • Recognize arithmetic patterns, including patterns in addition or multiplication tables, and explain the patterns using properties of operations.
3.NBT.A.1 (**A**) Use place value understanding to round whole numbers to the nearest 10 or 100.	MP.2 Reason abstractly and quantitatively.	Concepts: • Rounding leads to an approximation or estimate.

		Students will be able to: • Use number lines and a hundreds chart to explain rounding numbers to the nearest 10 and 100. • Round a whole number to the nearest 10. • Round a whole number to the nearest 100. Learning Goal 11: • Round whole numbers to the nearest 10 or 100.
3.NBT.A.3 (**A**) Multiply one-digit whole numbers by multiples of 10 in the range 10–90 (e.g. 9 x 80, 5 x 60) using strategies based on place value and properties of operations.	MP.2 Reason abstractly and quantitatively.	Concepts: • Multiples of 10 can be represented as a specific number of groups of ten. Students will be able to: • Multiply to determine the total number of groups of ten. • Multiply one-digit whole numbers by multiples of 10. Learning Goal 12: • Multiply one digit whole numbers by multiples of 10 (10-90).
3.OA.B.5 (**M**) Apply properties of operations as strategies to multiply and divide. Examples: If 6 x 4 = 24 is known, then 4 x 6 = 24 is also known. (Commutative property of multiplication.) 3 x 5 x 2 can be found by 3 x 5 = 15, then 15 x 2 = 30, or by 5 x 2 = 10, then 3 x 10 = 30. (Associative property of multiplication.) Knowing that 8 x 5 = 40 and 8 x 2	MP.3 Construct viable arguments and critique the reasoning of others. MP.5 Use appropriate tools strategically.	Concepts: • Properties are rules about relationships between numbers. • Changing the order of factors does not change the result of multiplication. • Changing the order of

= 16, one can find 8 x 7 as 8 x (5 + 2) = (8 x 5) + (8 x 2) = 40 + 16 = 56. (Distributive property.) (Clarification: Students need not use formal terms for these properties).	MP.6 Attend to precision. MP.7 Look for and make use of structure.	numbers does change the result of division. • Area models can be used to represent the distributive property. Students will be able to: • Multiply whole numbers using the commutative property as a strategy. • Multiply whole numbers using the associative property as a strategy. • Multiply whole numbers using the distributive property as a strategy. Learning Goal 13: • Multiply one-digit whole numbers by applying the properties of operations (commutative, associative, and distributive properties).

School/District Formative Assessment Plan

- Topic 6-1 through 6-7 Quick Check (found in Savvas Realize).
- Topic 7-1 through 7-5 Quick Check (found in Savvas Realize).
- Topic 8-1 through 8-8 Quick Check (found in Savvas Realize).
- Topic 9-1 through 9-7 Quick Check (found in Savvas Realize).
- Topic 10-1 through 10-4 Quick Check (found in Savvas Realize).

School/District Summative Assessment Plan

- Topic 6 Assessment
- Topic 7 Assessment
- Topic 8 Assessment
- Topic 9 Assessment
- Topic 10 Assessment

Benchmark & Alternative Assessments

- STAR Renaissance
- LinkIt Benchmarks
- Performance Tasks (found in Savvas Realize)

Focus Mathematical Concepts

Pre-requisite skills

- Measure lengths of objects after selecting appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes (2.M.A.1).
- Compose two-dimensional shapes (rectangles, squares, trapezoids, triangles, half-circles, and quarter circles) to create a composite shape (2.G.A.2).
- Partition a rectangle into rows and columns of same-size squares and count to find the total number of same size squares (2.G.A.2).
- Draw a picture graph to represent a data set with up to four categories (2.DL.B.4).
- Draw a bar graph to represent a data set with up to four categories (2.DL.B.4).
- Use information from a bar graph to solve simple put together, take-apart, and compare problems (2.DL.B.4).
- Use repeated addition to find the total number of objects arranged in rectangular arrays with up to 5 rows and up to 5 columns (2.OA.C.4).
- Write an equation to express the total number of objects arranged in a rectangular array as a sum of equal addends (2.OA.C.4).
- Represent a word problem using drawings and equations using a symbol for the unknown (2.OA.A.1).

- Solve one and two-step addition and subtraction word problems within 100 involving situations of adding to, taking from, putting together, taking apart, and comparing (2.OA.A.1).
- Use concrete models and a place value strategy to add and subtract within 1000, and relate the written strategy to the model (2.NBT.B.7).
- Use drawings and a place value strategy to add and subtract within 1000, and relate the written strategy to the drawing (2.NBT.B.7).
- Use concrete models and a strategy based on properties of operations and/or the relationship between addition and subtraction to add and subtract within 1000, and relate the written strategy to the model (2.NBT.B.7).
- Use drawings and a strategy based on properties of operations and/or the relationship between addition and subtraction to add and subtract within 1000, and relate the written strategy to the drawing (2.NBT.B.7).
- Determine whether a group of objects up to 20 is odd or even (e.g., by pairing objects, counting them by 2s) (2.OA.C.3).
- Write an equation to express an even number as a sum of two equal addends (2.OA.C.3).
- A three-digit number is made up of hundreds, tens, and ones (2.NBT.A.1).
- The three digits of a three-digit number represent amounts of hundreds, amounts of tens, and amounts of ones (2.NBT.A.1).
- 100 is a bundle of ten tens called a “hundred” (2.NBT.A.1).
- The numbers 100, 200, 300, 400, 500, 600, 700, 800, and 900 refer to 1, 2, 3, 4, 5, 6, 7, 8, or 9 hundreds (and 0 tens and 0 ones) (2.NBT.A.1).

Common Misconceptions

- Although intervals on a bar graph are not in single units, students count each square as one. To avoid this error, have students include tick marks between each interval. Students should begin each scale with 0. They should think of skip-counting when determining the value of a bar since the scale is not in single units.
- The use of terms like “round up” and “round down” confuses many students. For example, the number 37 would round to 40 or they say it “rounds up”. The digit in the tens place is changed from 3 to 4 (rounds up). This misconception is what causes the problem when applied to rounding down. The number 32 should be rounded (down) to 30, but using the logic mentioned for rounding up, some students may look at the digit in the tens place and take it to the previous number, resulting in the incorrect value of 20. To remedy this misconception, students need to use a number line to visualize the placement of the number and/or ask questions such as: “What tens are 32 between and which one is it closer to?” Developing the understanding of what the answer choices are before rounding can alleviate much of the misconception and confusion related to rounding.

Number Fluency

- 3.OA.C.7 Multiply and divide within 100; Know single digit products from memory.

- 3.NBT.A.2 Add and subtract within 1000.

District/School Tasks

- Pick A Project (found in Savvas Realize)
- Performance Tasks (found in Savvas Realize)

District/School Primary, Supplemental, & Intervention Resources

- Envisions by Savvas
- STAR Renaissance
- Freckle Math
- Connecting Math Concepts
- Corrective Math

Instructional Best Practices/Open Educational Resources

Illustrative Mathematics

Desmos

Numeracy Tasks

Building Thinking Classrooms Tasks

Open Middle Math Tasks

Resources from Dr. Eric Milou

Career Readiness, Life Literacies, and Key Skills

WRK.9.2.5.CAP.3	Identify qualifications needed to pursue traditional and non-traditional careers and occupations.
WRK.9.2.5.CAP.4	Explain the reasons why some jobs and careers require specific training, skills, and certification (e.g., life guards, child care, medicine, education) and examples of these requirements.
TECH.9.4.5.CT.1	Identify and gather relevant data that will aid in the problem-solving process (e.g., 2.1.5.EH.4, 4-ESS3-1, 6.3.5.CivicsPD.2).
TECH.9.4.5.CT.3	Describe how digital tools and technology may be used to solve problems.
TECH.9.4.5.CT.4	Apply critical thinking and problem-solving strategies to different types of problems such as personal, academic, community and global (e.g., 6.1.5.CivicsCM.3).
TECH.9.4.5.TL.2	Sort and filter data in a spreadsheet to analyze findings.
TECH.9.4.5.IML.2	Create a visual representation to organize information about a problem or issue (e.g., 4.MD.B.4, 8.1.5.DA.3).
TECH.9.4.5.IML.3	Represent the same data in multiple visual formats in order to tell a story about the data.

Computer Science and Design Thinking

CS.3-5.8.1.5.DA.1	Collect, organize, and display data in order to highlight relationships or support a claim.
CS.3-5.8.1.5.DA.2	Compare the amount of storage space required for different types of data.
CS.3-5.8.1.5.DA.3	Organize and present collected data visually to communicate insights gained from different views of the data.
CS.3-5.8.1.5.DA.4	Organize and present climate change data visually to highlight relationships or support a claim.
CS.3-5.8.1.5.DA.5	Propose cause and effect relationships, predict outcomes, or communicate ideas using data.

Interdisciplinary Connections

ELA.RI.CR.3.1	Ask and answer questions and make relevant connections to demonstrate understanding of an informational text, referring explicitly to textual evidence as the basis for the answers.
ELA.RI.CI.3.2	Recount in oral and written form the key details from a multi-paragraph informational text and explain how they support the main idea.
ELA.RI.IT.3.3	Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect.
SCI.3-LS3-1	Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms.
ELA.W.AW.3.1	Write opinion texts to present an idea with reasons and information.
ELA.W.IW.3.2	Write informative/explanatory texts to examine a topic and convey ideas and information

	clearly.
SCI.3-LS3-2	Use evidence to support the explanation that traits can be influenced by the environment.
SCI.3-LS4-2	Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing.
ELA.SL.PI.3.4	Report on a topic or text, tell a story, or recount an experience with appropriate facts and relevant, descriptive details, speaking clearly at an understandable pace.
SCI.3-LS4-3	Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.
SCI.3-ESS2-1	Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.