GRADE 3 MATH: CITY FARMERS

UNIT OVERVIEW
This instructional bundle contains a task aligned to the Content Core standards and additional supports for diverse learners. The task is embedded in a 4-5 week unit on understanding concepts of area and relating area to multiplication and addition.

TASK DETAILS

Task Name: City Farmers

Grade: 3

Subject: Mathematics

Depth of Knowledge: 3

Task Description: Students extend their knowledge about area defined as counting the same size squares in a rectilinear array partitioned into rows and columns. In this unit, students are introduced to the concept of unit-square as an area of measurement. Students then explore the concept of area using operations of both multiplication and addition in real-world problems and hands-on gardening activities.

Standards:
3.MD.5 Recognize area as an attribute of plane figures and understand concepts of area measurement.
a. A square with side length 1 unit, called "a unit square," is said to have "one square unit" of area, and can be used to measure area.
b. A plane figure, which can be covered without gaps or overlaps by *n* unit squares, is said to have an area of *n* square units.
3.MD.6 Measure areas by counting unit squares (square cm, square m, square in, square ft, and improvised units).
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.

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3.MD.8 Solve real world and mathematical problems involving perimeters of polygons, including finding the perimeter given the side lengths, finding an unknown side length, and exhibiting rectangles with the same perimeter and different areas or with the same area and different perimeters.

Standards for Mathematical Practice:
MP.1 Make sense of problems and persevere in solving them.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.

TABLE OF CONTENTS

The task and instructional supports in the following pages are designed to help educators understand and implement Common Core–aligned tasks that are embedded in a unit of instruction. We have learned through our pilot work that focusing instruction on units anchored in rigorous Common Core–aligned assessments drives significant shifts in curriculum and pedagogy. Additional resources using Universal Design for Learning (UDL) support and Gardner's Multiple Intelligence Theory are included to provide multiple entry points for diverse learners.

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COMMON CORE-ALIGNED TASK
WITH INSTRUCTIONAL SUPPORTS

Mathematics

GRADE 3 MATH: CITY FARMERS

PERFORMANCE TASK

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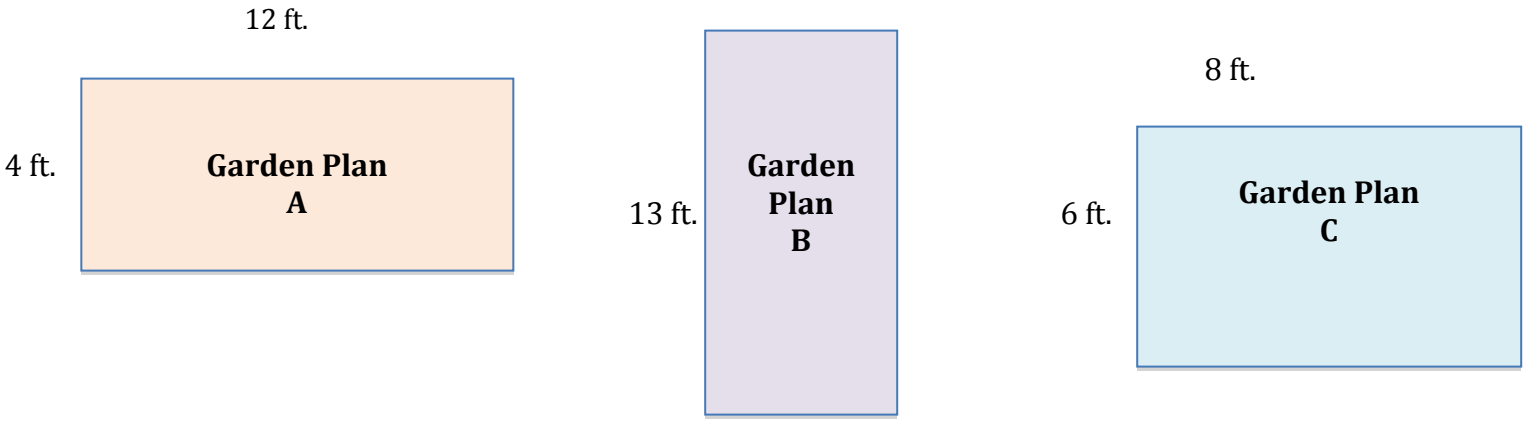
City Farmers

Principal Giuliani wants to make the entrance of the school look beautiful by adding a fenced garden of roses. He has drafted three different garden plans.



1a. If Garden Plan A and Garden Plan B have the same perimeter, what is the unknown side length of Garden Plan B? _____

1b. The principal wants to plant the largest number of flowers while using the least amount of fencing. Which plan should he choose? Justify your response.

1c. Which two garden plans have the **same** area? _____

1d. What is the **total area** of all three garden plans? _____

Your school has decided to build a garden on the roof to be used for growing vegetables for school lunches.

2. The school cafeteria worker would like to plant 5 rows of vegetables, in a sequence of 4 heads of cabbage followed by 6 potatoes in each row. Showing your work, explain how many total vegetables will grow this winter.

2a. **Draw** the garden in the space provided. **Label** the cabbage patch and the potato patch.

School Garden

Tomato Seed Packet	**Carrot** Seed Packet	**Lettuce** Seed Packet	**Corn** Seed Packet
Requires 2 square units per seed	Requires 2 square units per seed	Requires 2 square units per seed	Requires 2 square unit per seed

3. A new garden layout is designed. Class Y and Class Z make posters explaining how many vegetable seeds can be planted. Using the seed packet information above, which class is right?

<u>Seeds Planted</u>

Class Y Poster	
Tomatoes	6
Carrots	9
Lettuce	3
Corn	8

Class Z Poster	
Tomatoes	12
Carrots	3
Lettuce	3
Corn	6

Answer: _____

3a. Show and explain how the correct class poster garden plot can be partitioned into four vegetable patches. Draw the garden in the space provided. Label each vegetable patch.

4 ft.

12 ft

GRADE 3 MATH: CITY FARMERS

Scoring Guide, Rubric &

Circumstance of Performance

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Scoring Guide Rubric for *City Farmers*

Item #	*Standard*	*Example of Student Performance*	*Point Value*	*Total*
Problem #1	**3.MD.7** Relate area to the operations of multiplication and addition. **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.	In problem #1, the student correctly solves for area by multiplying side lengths (Plan A=48, Plan B=39, Plan C=48).	**1 point**	
	3.MD.7 Relate area to the operations of multiplication and addition. **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.	In problem #1, the student adds the three garden plot areas to find the total garden area.	**1 point**	
	3.MD.8 Solve real world and mathematical problems involving perimeters of polygons, including finding the perimeter given the side lengths, finding an unknown side length, and exhibiting rectangles with the same perimeter and different areas or with the same area and different perimeters.	In problem #1, the student solves correctly for perimeter (Plan A and B= 32, Plan C= 28). In problem #1, the student solves correctly for the unknown side length in Plan B (3 ft.). In problem #1, the student recognizes the largest area and smallest perimeter is Plan C (48 sq. ft. and 28 feet).	**3 points**	
Math Practices Problem #1	**MP.3** Construct viable arguments and critique the reasoning of others.	• Deductive arguments are used to justify decisions and may result in formal proofs. • Evidence is used to justify and support decisions made and conclusions reached. This may lead to… 1. Testing and accepting or rejecting of a hypothesis of conjecture. 2. Explanation of phenomenon. 3. Generalizing and extending the solution to other cases. (Source: Exemplars)	**1 point**	**6 points**
Problem # 2	**3.MD.7** Relate area to the operations of multiplication and addition. **c.** Use tiling to show in a	In problem #2, the student demonstrates an understanding of distributive property.	**1 point**	

Item #	*Standard*	*Example of Student Performance*	*Point Value*	*Total*
	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.			
	3.MD.7 Relate area to the operations of multiplication and addition. **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.	In problem #2, the student subdivides the rectangle into two parts and finds the area.	**1 points**	
	3.MD.7 Relate area to the operations of multiplication and addition. **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.	In problem #2, the student is able to demonstrate that multiplying side lengths is one way to solve for area.	**1 point**	
Math Practices Problem # 2	**MP.1** Make sense of problems and preserve in solving them.	• An efficient strategy is chosen and progress towards solution is evaluated. • Adjustments in strategy if necessary are made along the way, and/or alternative strategies are considered. • Evidence of analyzing the situation in mathematical terms, and extending prior knowledge is present. (Source: Exemplars)	**1 point**	
	MP.4 Model with mathematics.	• Abstract or symbolical mathematical representations are constructed to analyze relationships, extend thinking, and clarify or interpret phenomenon. They create the equation: (20 + 30 = 50) (Source: Exemplars)	**2 points**	**6 points**
Problem #3	**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"	In problem #3, the student correctly shows that 1 square equates to 1 unit by matching number of tiles to side lengths.	**1 point**	

Item #	*Standard*	*Example of Student Performance*	*Point Value*	*Total*
	of area, and can be used to measure area.			
	3.MD.5 Recognize area as an attribute of plane figures and understand concepts of area measurement. **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.	In problem #3, the student uses all spaces of the garden; work shown does not have gaps or overlap unit squares.	**1 point**	
	3.MD.6 Measure areas by counting unit squares (square cm, square m, square in, square ft, and improvised units).	In problem #3, the student correctly figures out the area of the figure by counting 48 unit squares.	**1 point**	
	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.	In problem #3, the student places the lettuce patch in the top figure by understanding area as multiplication 6 x 2 meaning 6 seeds planted multiplied by 2 square units per seed.	**4 points**	
	3.MD.7 Relate area to the operations of multiplication and addition. **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.	In problem #3, the student correctly finds area of the figure by multiplying side lengths (4 x 12= 48).	**1 point**	
Math Practices Problem 3	**MP.1** Make sense of problems and preserve in solving them.	• An efficient strategy is chosen and progress towards solution is evaluated. • Adjustments in strategy if necessary are made along the way, and/or alternative strategies are considered. • Evidence of analyzing the situation in mathematical terms, and extending prior knowledge is present. (Source: Exemplars)	**1 point**	
	MP.3 Construct viable arguments and critique the reasoning of others.	• Deductive arguments are used to justify decisions and may result in formal proofs. • Evidence is used to justify and support decisions made and conclusions reached. This may lead to… 1. Testing and accepting or rejecting of a hypothesis of conjecture. 2. Explanation of phenomenon. 3. Generalizing and extending the solution to other cases. (Source: Exemplars)	**1 point**	

Item #	*Standard*	*Example of Student Performance*	*Point Value*	*Total*
	MP.4 Model with mathematics.	• Abstract or symbolical mathematical representations are constructed to analyze relationships, extend thinking, and clarify or interpret phenomenon. (Source: Exemplars)	**2 points**	**12 points**
Total for City Farmers				**24 points**

Total Points	☐ **Level 3**	☐ **Level 2**	☐ **Level 1**
_____	17 to 24 points	8 to 16 points	1 to 7 points

STUDENT FRIENDLY Scoring Guide Rubric for *City Farmers*

PROBLEMS	What I need to do	What I earn for each problem	TOTAL POSSIBLE POINTS
PROBLEM 1	I correctly find the area by multiplying the lengths of each side.	1 POINT	
	I solve correctly by adding the 3 garden plot areas to find the total garden area.	1 POINT	
	I solve correctly for perimeter and identify the two garden plots with the same perimeter. I solve correctly for the unknown side of the garden plot in Plan B. I recognize and identify the largest area and smallest perimeter is Plan C.	1 POINT 1 POINT 1 POINT	
MATH PRACTICES **PROBLEM 1**	I explained what I did and gave reasons for how I solved this problem.	1 POINT	6 POINTS
PROBLEM 2	I show that I understand the distributive property.	1 POINT	
	I divide the rectangle into 2 parts to find the area.	1 POINT	
	I show that I multiplied the lengths of the sides to find the area.	1 POINT	
MATH PRACTICES **PROBLEM 2**	I used strategies that helped me find my answer easily. I draw and label the garden plot. I use an addition number sentence to show how I found the area.	1 POINT 2 POINTS	6 POINTS
PROBLEM 3	I used addition and multiplication to find the area of the garden before I tile it.	1 POINT	
	I use multiplication or repeated addition to find out how many of each vegetable belong in the garden.	1 POINT	
	I correctly show what 1 unit looks like by	1 POINT	

PROBLEMS	What I need to do	What I earn for each problem	TOTAL POSSIBLE POINTS
	matching the tiles to the side lengths.		
	I use all the spaces in the rectangle to show where all the vegetables are planted. I do not leave any spaces blank.	4 POINTS	
	I use counting when finding the area of the garden.	1 POINT	
MATH PRACTICES **PROBLEM 3**	I used strategies that helped me find my answer easily. I explained what I did and gave reasons for how I solved this problem. I draw and label the garden plot. I use an addition number sentence to show how I found the area.	1 POINT 1 POINT 2 POINTS	12 POINTS
Total for City Farmers			**24 Points**

Total Points	☐ **Level 3**	☐ **Level 2**	☐ **Level 1**
_____	17-24 points	8-16 points	1-7 points

Circumstance of Performance

Student Name _____ **Date** _____

Task Description: The final performance assessment entitled *City Farmers* should be administered at the end of the unit. In the first problem, students must solve for an unknown side length of a garden (3.MD.8) and calculate the area of three different garden plots (3.MD.7b). Then, students are expected to solve a real-world problem by exhibiting different perimeters and areas by justifying why a garden plan with the largest number of flowers and least amount of fencing should be chosen (3.MD.8). In the second problem, students understand concepts of area measurement when interpreting and using the seed packet information appropriately to demonstrate knowledge of a "unit square" (3.MD.5a, 3.MD.5b). Students are then asked to find the area of a garden through multiplication and determine the side lengths in a real-world problem (3.MD.7a, 3.MD.7b). They relate area as additive when adding the areas of non-overlapping plant beds to figure out the area for the whole garden (3.MD.7d). In the third problem, students measure area by counting the unit squares representing a bed of lettuce (3.MD.6). They are also able to demonstrate an understanding of area by multiplying the side lengths of the garden (3.MD.7b). Finally, students must demonstrate understanding of area using the distributive property when partitioning the garden in their garden layout (3.MD.7c) and then adding the decomposed figures to find the total area (3.MD.7d). An opportunity for mathematical practices 1, 3, and 4 are presented when students monitor and evaluate their progress, critique the reasoning of garden plans and garden posters, and model mathematics by using geometry to solve a garden design problem.

Circumstances of Performance

☐ In Small Group ☐ 1:1 Assistance ☐ Independent

Levels of Support

☐ _____% Adult Support _____% Peer Support Other: _____

☐ Full Physical (hand over hand) ☐ Partial Physical ☐ Gestural ☐ Visual ☐ Verbal

Comments

Next Steps (specific to Common Core)

GRADE 3 MATH: CITY FARMERS

ANNOTATED STUDENT WORK

This section contains annotated student work at a range of score points. The student work shows examples of understandings and misunderstandings of the task.

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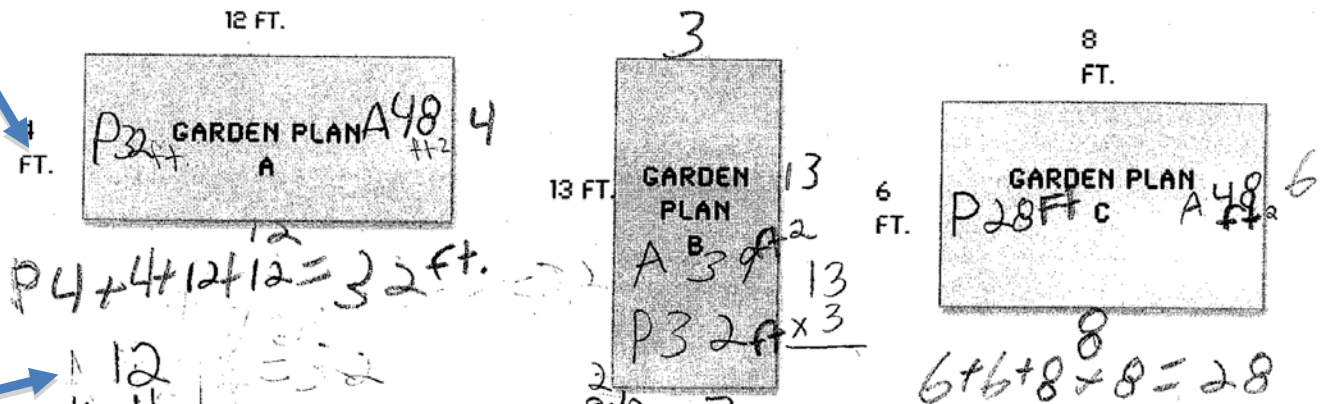
Grade 3 Math: City Farmers
Annotated Student Work: Level 4

The student's response exceeds the demands of nearly all of the standards as defined by the Common Core. The student response shows understanding and use of stated assumptions, definitions and previously established results in the construction of arguments. The student is able to make conjectures and build a logical progression of statements to explore the truth of his/her own conjecture. The student response routinely interprets his/her mathematical results in the context of the situation and reflects on whether the results make sense. The communication is precise, using definitions clearly. The student looks closely to discern a pattern or structure. The body of the work looks at the overall situation of the problem and process, while attending to the details.

3.MD.8 The student correctly solves for perimeter for all three garden plans.

Principal Giuliani wants to make the entrance of the school look beautiful by adding a fenced garden of roses. He has drafted three different garden plans.



3.MD.7b The student finds area by multiplying side lengths.

1a. If Garden Plan A and Garden Plan B have the same perimeter, what is the unknown side length of Garden Plan B? 3 ft.

3.MD.8 The student subtracts Garden Plan A (32 ft.) from Garden Plan B (26 ft.) and divides the width in half to find an unknown side length.

1b. The principal wants to plant the largest number of flowers while using the least amount of fencing. Which plan should he choose? Justify your response.

See Answer on Attached Paper.

1c. Which two garden plans have the same area? plot A plot B

1d. What is the **total area** of all three garden plans? 135 ft.²

3.MD.7d The student added the areas of the three plots to find the total area and explained the rationale.

48+39+48=135 ft.

I found the Area by Adding the three Garden Plans.

1b.

The principal would choose plot C because it has the least amount of perimeter, 28 ft but the largest area 48 ft plot A also has an area of 48 ft² plot 48 but does not have the least amout of perimeter of fencing. The perimeter of plot A is 32 ft

3.MD.8 The student recognizes the largest area and smallest perimeter is Plan C. The response clearly expresses mathematical thinking.

3.MD.7c The side lengths of each patch are added to solve for area using distributive property.

MP1 The student perseveres in solving the problem by using three methods to verify his/her answer: counting units, adding the decomposed areas to find the total area, and using distributive property.

MP1 The student makes sense of the problem by applying an efficient strategy of composing cabbage and vegetable patches.

3.MD.7d The student understands that each vegetable is a unit square and composes a garden figure in non-overlapping parts.

cccc pppppp

4
x 5
20

6x5=30

20
+30
50

3.MD.7b The student recognizes the total garden as two patches: cabbage (4x5) and potato (6x5). The student solves for area by multiplying side lengths.

3.MD.7d The student recognizes area as additive by adding the areas of the cabbage patch and lettuce patch.

2.

I found that 50 vegetables could be planted
I found this dy adding four cabbage plus
six potatoes to get the side lenth of 10. Then
I multiplied 10 by 5 the total area of 50.
I cheked this by multiplied four cabbages
in the row by 5 the number of rows to get
20. I then multiplied 6 potatoes by 5 to
get 30. I added the two vegetables 20+30
=50.

Tomato Seed Packet	Carrot Seed Packet	Lettuce Seed Packet	Corn Seed Packet
Require 2 square units per seed	Require 2 square units per seed	Require 2 square units per seed	Require 2 square unit per seed

3. A new garden layout is designed. Class Y and Class Z make posters explaining how many vegetable seeds can be planted. Using the seed packet information, which class is right?

MP.1 The student makes sense of the problem by finding the correct number of seeds planted for each Class by reading and using the key information.

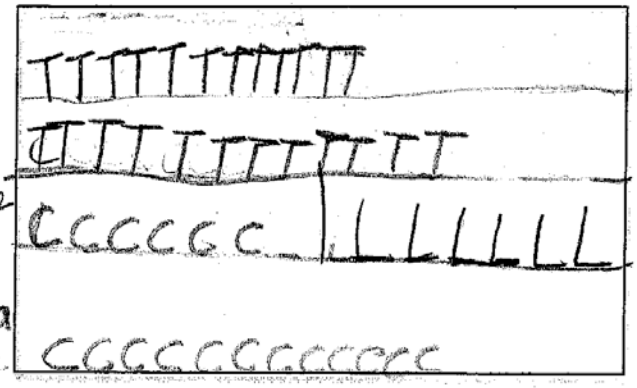
Seeds Planted

CLASS Y POSTER		CLASS Z POSTER	
TOMATOES	6 x 2 = 12	TOMATOES	12 x 2 = 24
CARROTS	9 x 2 = 18	CARROTS	3 x 2 = 6
LETTUCE	3 x 2 = 6	LETTUCE	3 x 2 = 6
CORN	8 x 2 = 16	CORN	6 x 2 = 12
	52		48

Class Z can be planted in the School garden.

Show and explain how the correct Class Poster garden plot can be partitioned into four vegetable patches. Draw the garden in the space provided. Label each vegetable patch.

3.MD.7a The student correctly solves for area by multiplying side lengths 4x12



12 x 4 = 48 ft²

48 is the Area of the School Garden Plot.

3.MD.5a The student uses the correct number of unit squares for each vegetable to match the square feet.

3.MD.6 The student uses the correct amount of vegetables in garden and verifies response through counting.

MP1 The student perseveres through the problem by using multiple methods to check and verify work for reasonableness and accuracy.

3.

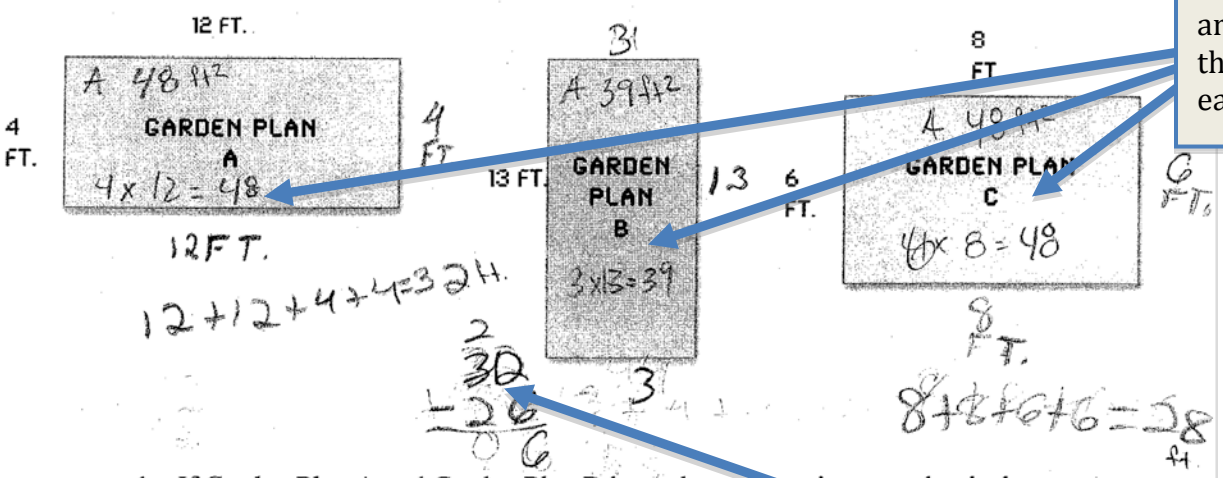
I found class z could plant in the school garden by comparing the two posters.
I found class y needed 52 ft^2 and this couldent fit in the school garden is too to small for it. I found the area of the school garden to be 48 ft^2 this matches the total area of the school garden.

MP3 The student critiques the reasoning of others by comparing the information presented in the posters. The student further explains that the answer was solved by figuring out the amount of space required for each class garden.

Grade 3 Math: City Farmers
Annotated Student Work: Level 3

For most of the task, the student response meets the main elements of performance. The response is organized as a coherent attack on the core of the problem. The student provides a minimal explanation, if any, of the problem and identifies constraints. They make sense of quantities and their relationship to the problem situations. S/he often uses abstractions to represent a problem symbolically or with other mathematical representations. The student response may use assumptions, definitions, and previously established results in constructing arguments. S/he may make conjectures and build a logical progression of statements to explore the truth of their conjectures. The student might discern patterns or structures and make connections between representations. With some more time for checking and revision, excellent solutions would seem likely
.

Principal Giuliani wants to make the entrance of the school look beautiful by adding a fenced garden of roses. He has drafted three different garden plans.



1a. If Garden Plan A and Garden Plan B have the same perimeter, what is the unknown side length of Garden Plan B? _____

1b. The principal wants to plant the largest number of flowers while using the least amount of fencing. Which plan should he choose? Justify your response.

1c. Which two garden plans have the same area? _____

1d. What is the **total area** of all three garden plans? _____

3.MD.7b The student correctly solves for area by multiplying the side lengths of each garden.

3.MD.8 The student solves correctly for the unknown side length by subtracting the perimeter of Garden Plan A (32 ft.) from the perimeter of Garden Plan B (26 ft). Then, the student divides the width in half to find a length of 3 ft.

3.MD.8 The correct answer is given; however, the student's justification is incomplete.

3.MD.7 The student is able to recognize area as additive by adding the areas of all three garden plans.

3.MD.7 The student arrives at the correct answer and shows his/her computations above in the figures.

Your school has decided to build a garden on the roof to be used for growing vegetables for school lunches.

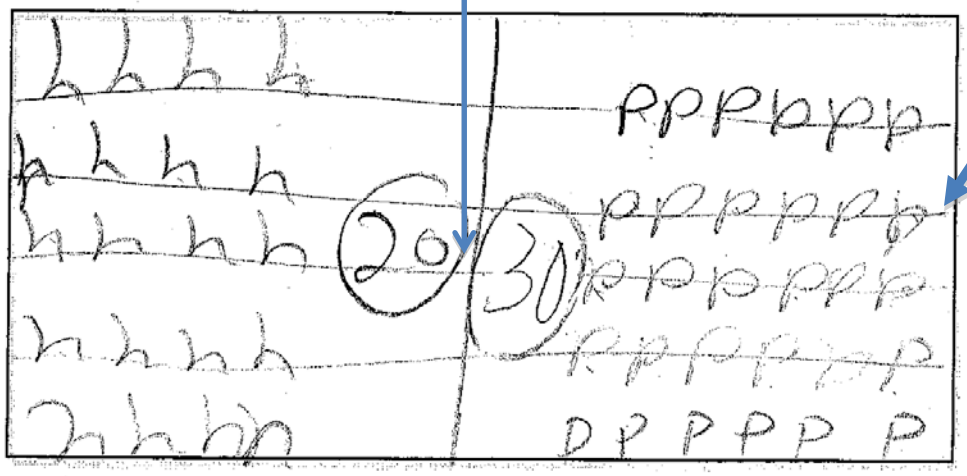
The school cafeteria worker would like to plant 5 rows of vegetables, in a sequence of 4 heads of cabbage followed by 6 potatoes in each row. Showing your work, explain how many total vegetables will grow this winter.

Draw the garden in the space provided. **Label** the cabbage patch and the potato patch.

3.MD.7d The student correctly understands area as additive with the decomposed plots to find the total area of the garden.

MP.4 The student shows limited communication in labeling the heads of cabbage and potato patches.

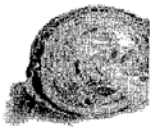
School Garden



3.MD7c The student demonstrates an understanding of distributive property in the labeling of the drawing and sing an equations to solve the problem using distribution as a method to find or verify the answer.

$$\begin{array}{r} 20 \\ +\ 30 \\ \hline 50 \end{array}$$

MP1 The student responds with equations; however, explanations have not extended to a written response justifying rationale.

Tomato Seed Packet	Carrot Seed Packet	Lettuce Seed Packet	Corn Seed Packet
			
Require 2 square units per seed	Require 2 square units per seed	Require 2 square units per seed	Require 2 square unit per seed

3. A new garden layout is designed. Class Y and Class Z make posters explaining how many vegetable seeds can be planted. Using the seed packet information, which class is right?

Seeds Planted

CLASS Y POSTER		CLASS Z POSTER	
TOMATOES	6×2=12	TOMATOES	12×2=24
CARROTS	9×2=18	CARROTS	3×2=6
LETTUCE	3×2=6	LETTUCE	3×2=6
CORN	8×2=16	CORN	6×2=12

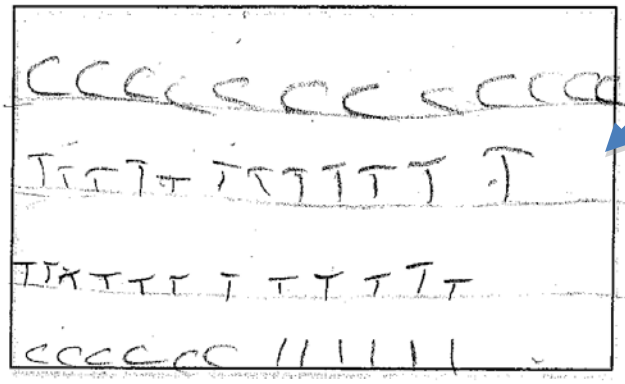
12 + 18 + 6 + 16 = 52

24 + 6 + 6 + 12 = 48

MP1 The student makes sense of the problem by finding the total amount of seeds planted for each garden. Using the key and information provided, the student multiplies the seed packets by the vegetables in a real-world context.

Show and explain how the correct Class Poster garden plot can be partitioned into four vegetable patches. Draw the garden in the space provided. Label each vegetable patch.

4 ft.



12 ft.

3.MD.7d The student correctly labels the garden plan with the appropriate number of vegetables needed for each unit square to fill the total square feet.

12 × 4 = 48 ft

3.MD.7b The student correctly found the available area of the garden by multiplying the side lengths.

MP3 The student identifies which class was correct by circling the garden poster; however, the student shows limited communication and does not express the process and defend answer with clearly written response.

Grade 3 Math: City Farmers
Annotated Student Work: Level 3

Implications for Instruction

Although, the student was able to attend to precision with correct calculations; further improvement is possible in this level of student work. To move towards a level four, the student will need to demonstrate a coherent attack of the problem by solving using multiple methods, if possible, and justifying responses through clearly articulated descriptions describing the *how* and *why* of a solution.

To achieve a level four, the student would benefit from additional opportunities to explain his/her rationale and justify his/her reasoning. To aid in this work, we recommend using graphic organizers to assist in the construction of a well-developed argument.

Also, the student should receive consistent and timely feedback on homework, do-now assignments, small group work, and independent work throughout the unit. Students at this level need further support and guidance in how to explain their mathematical thinking. Comments and high quality questions to deepen critical thinking should be offered for the student to describe answers.

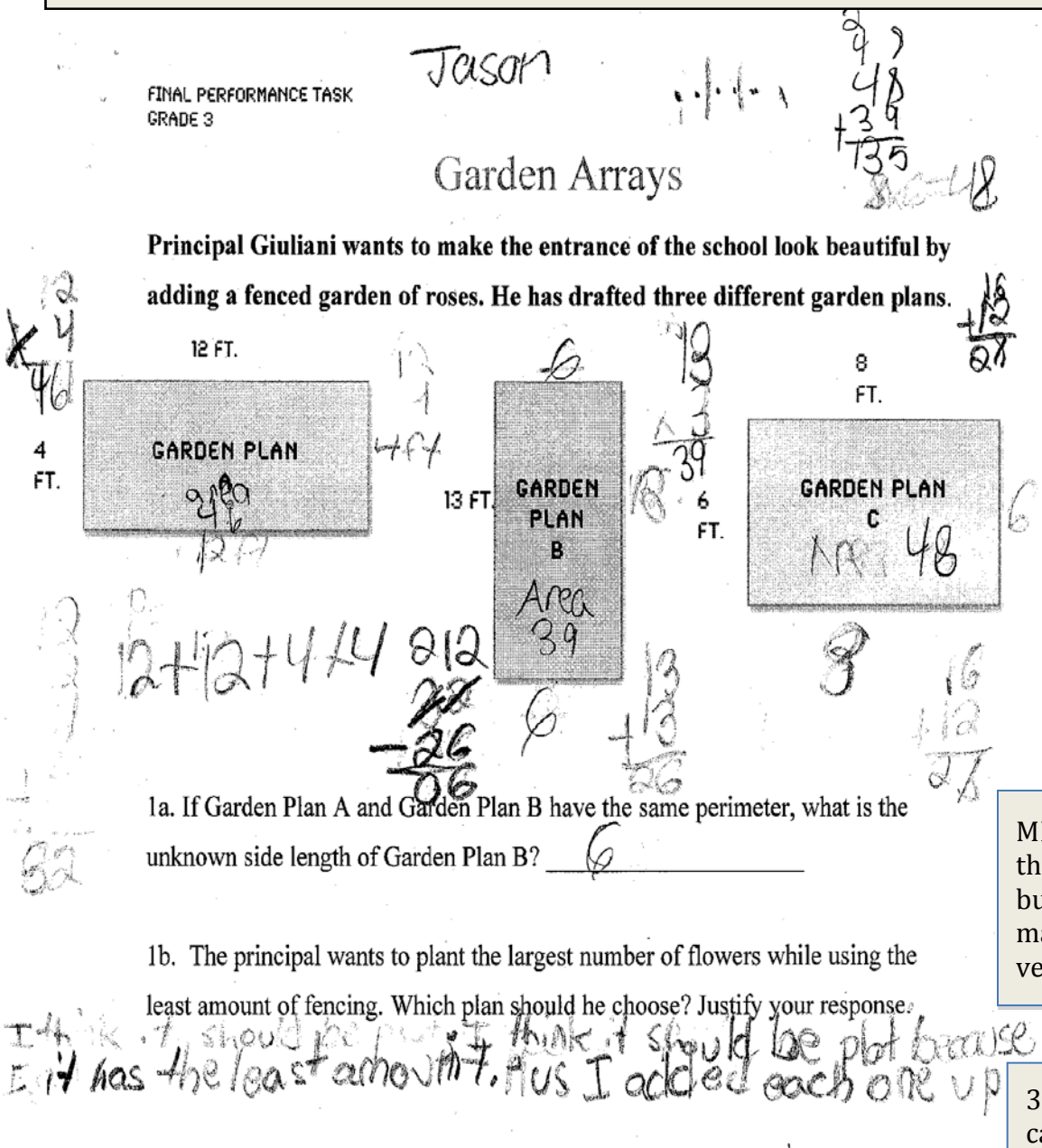
We recommend having the students act out problem and model the problem using manipulatives or drawings to a math buddy and/or teacher. After the child has presented the problem using tactile or kinesthetic descriptions, the student should be prompted to orally use words to explain the steps in solving the problem in the second round to a new math buddy and/or teacher. Having the student practice expressing his mathematical thinking before using words on paper may help retrieve a more detailed and full response.

Finally, for students who have met the standard but not exceeded expectations, we recommend supporting students with a problem-solving checklist. Students should be encouraged to participate in the authoring of the resource to increase autonomy. Examples of items on the checklist may include:

1. What is another way I can solve the problem to check my work?
2. Why is my answer correct?
3. How do I know for sure that it is correct? What proof can I show?
4. If I met an alien, how would I explain the steps to solving the problem?

Grade 3 Math: City Farmers
Annotated Student Work: Level 2

The student's response shows some of the elements of performance that the task demands and some signs of a coherent attack on some problems. However, the shortcomings are substantial, and the evidence suggests that the student would not be able to produce high-quality solutions without further instruction. The student may occasionally make sense of quantities in relationships in the problem, but the use of quantity is limited or not fully developed. While the student makes a coherent attack on the problem, it is incomplete. The student may recognize some patterns or structures, but has trouble generalizing or using them to solve the problem.



FINAL PERFORMANCE TASK
GRADE 3

Jason

Garden Arrays

Principal Giuliani wants to make the entrance of the school look beautiful by adding a fenced garden of roses. He has drafted three different garden plans.

12 FT. 4 FT. GARDEN PLAN

13 FT. 6 FT. GARDEN PLAN B Area 39

8 FT. GARDEN PLAN C

1a. If Garden Plan A and Garden Plan B have the same perimeter, what is the unknown side length of Garden Plan B? 6

1b. The principal wants to plant the largest number of flowers while using the least amount of fencing. Which plan should he choose? Justify your response.

I think it should be plot because it has the least amount of fence. Plus I added each one up

1c. Which two garden plans have the same area? NO Garden plots have the Same area

1d. What is the **total area** of all three garden plans? 137

3.MD.7b The student correctly solved the area for Plan B and C by multiplying the side lengths.

3.MD.8 The student solved correctly for the perimeter of Plan A and followed the correct process to solve for the unknown side length; however, the student did not divide 6 by 2 to demonstrate an understanding of geometric measurement.

MP.3 The student arrived at the correct answer (Plan C), but the communication of mathematical thinking was very limited in the response.

3.MD.8 Due to a multiplying calculation error in Plan A, the student was not able to arrive at the answer.

3.MD.7d The student understands how to solve for the total area, but the computation error in Plan A prohibited arriving at the correct

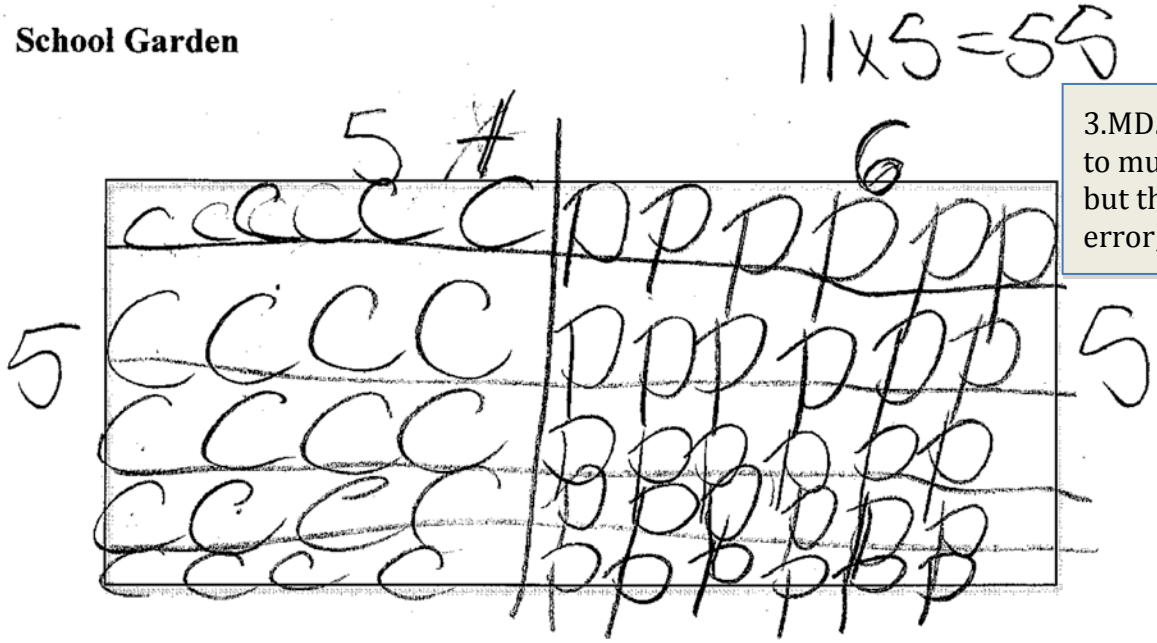
Your school has decided to build a garden on the roof to be used for growing vegetables for school lunches.

The school cafeteria worker would like to plant 5 rows of vegetables, in a sequence of 4 heads of cabbage followed by 6 potatoes in each row. Showing your work, explain how many total vegetables will grow this winter.

Draw the garden in the space provided. **Label** the cabbage patch and the potato patch.

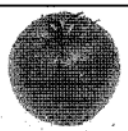
The student modeled mathematics using drawings to show the potato patch; however, there was a computation error in the cabbage patch. The student illustrated 5 heads of cabbage per row (totaling 25) instead of 4 heads of cabbage per row (totaling 20). The student clearly labeled the side lengths of the garden.

School Garden



3.MD.7b The student knows to multiply the side lengths but there is a calculation error; it should read 10x5

3.MD.7c The student attempts to demonstrate an understanding of distributive property in the labeling of the drawing; however, the student did not use equations or words to solve the problem using distribution as a method to find or verify the answer.

Tomato Seed Packet	Carrot Seed Packet	Lettuce Seed Packet	Corn Seed Packet
			
Require 2 square units per seed	Require 2 square units per seed	Require 2 square units per seed	Require 2 square unit per seed

3. A new garden layout is designed. Class Y and Class Z make posters explaining how many vegetable seeds can be planted. Using the seed packet information, which class is right?

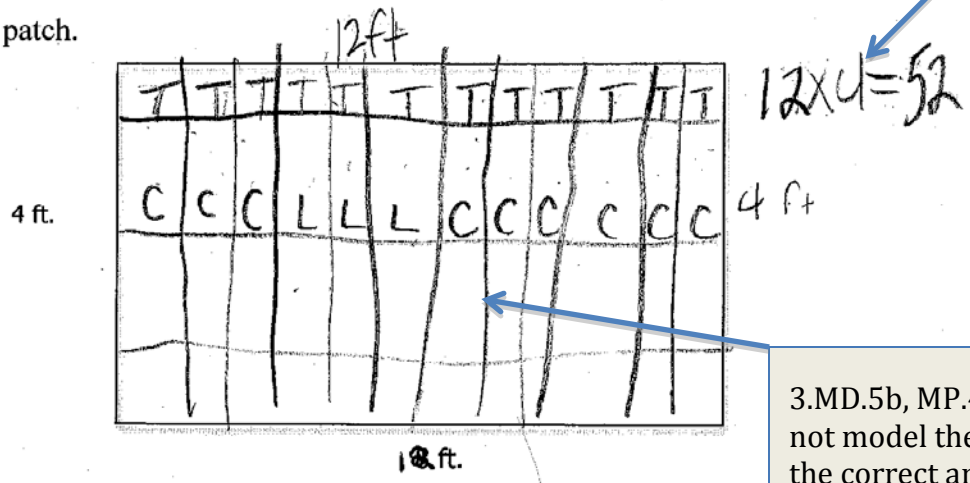
Seeds Planted

CLASS Y POSTER	
TOMATOES	6
CARROTS	9
LETTUCE	3
CORN	8

CLASS Z POSTER	
TOMATOES	12
CARROTS	3
LETTUCE	3
CORN	6

The student identifies the correct answer by circling the class poster; however, communication can be improved with the addition of words.

Show and explain how the correct Class Poster garden plot can be partitioned into four vegetable patches. Draw the garden in the space provided. Label each vegetable patch.



3.MD.7b The student understands how to solve for area by multiplying side lengths; however, there was a computation error.

3.MD.5b, MP.4 The student does not model the math correctly with the correct amount of vegetables using the seed packet information, and there are gaps in the garden plan.

Grade 3 Math: City Farmers
Annotated Student Work: Level 2

Implications for Instruction

Students need support with reasoning abstractly and quantitatively. Third graders experiment with representing problem situations in multiple ways including numbers, words (mathematical language), drawing pictures, using objects, acting out, making a chart, list, or graph, creating equations, etc. Students would benefit from creating mathematical models in multiple ways.

Students need support communicating precisely. Some communication of an approach is evident but further instruction should engage various approaches using verbal/written accounts and explanations, diagrams or objects, writing, and mathematical symbols.

Students would also benefit from direct instruction on how to justify claims. The explicit teaching of sentence frames can be a resource for some students: “My answer is ___ because _____.”

Furthermore, partner talks are recommended to guide inquiry and explain mathematical thinking. Key questions that are encouraged in pairs and teacher facilitation include:

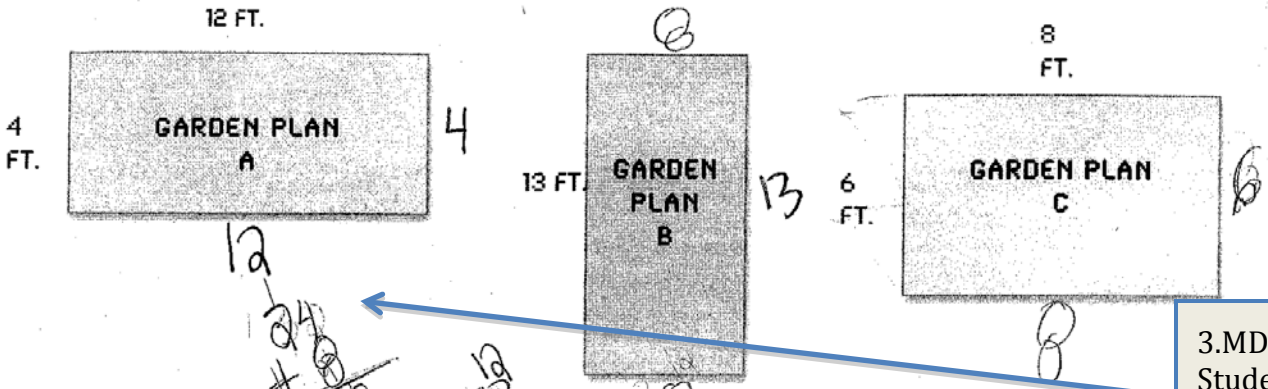
1. What are the key words? What words tell you to add the areas?
2. How did you use tiles to find the area?
3. At what step did you get ____ and I got ____? (Students compare answers and reason.)
4. Can you find another way to solve the problem?
5. Why are you overlapping the tiles? (if the student is incorrect in positioning of tiles)

Instruction should be focused on why a representation makes sense, not merely on finding the answer to problems in context. Finally, students might benefit from the direct instruction on how to check work, specifically on how to verify calculations in basic properties of operation.

Grade 3 Math: City Farmers
Annotated Student Work: Level 1

The student's response shows few of the elements of performance the tasks demand. The work shows a minimal attempt on the problem, and a struggle to make a coherent attack on the problem. Communication is limited and justification for reasoning is not evident. The student's response does not show if a strategy is chosen or the selected strategy will not lead to a solution. Significant further instruction is required.

Principal Giuliani wants to make the entrance of the school look beautiful by adding a fenced garden of roses. He has drafted three different garden plans.



1a. If Garden Plan A and Garden Plan B have the same perimeter, what is the unknown side length of Garden Plan B? _____

1b. The principal wants to plant the largest number of flowers while using the least amount of fencing. Which plan should he choose? Justify your response.

I think it will be 13 because it's bigger then 4.

1c. Which two garden plans have the same area? B C

1d. What is the **total area** of all three garden plans? 51

3.MD.8
Student calculates the correct perimeter for Plan A.

3.MD.8
The student does not find the correct side lengths. (The process of solving the answer is correct. Plan A is subtracted from Plan B, but there is a borrowing error in the calculations.)

3.MD.8
Student does not find the largest area with the smallest perimeter.

3.MD.7d
The student recognizes that three answers needed to be added to find the total; however, the student does not correctly calculate the areas of the three plots. (Rather than finding the area by *multiplying* side lengths, the student *added* the side lengths to find the area of each plot.)

3.MD.7b The student does not multiply to find the area or show work.

Your school has decided to build a garden on the roof to be used for growing vegetables for school lunches.

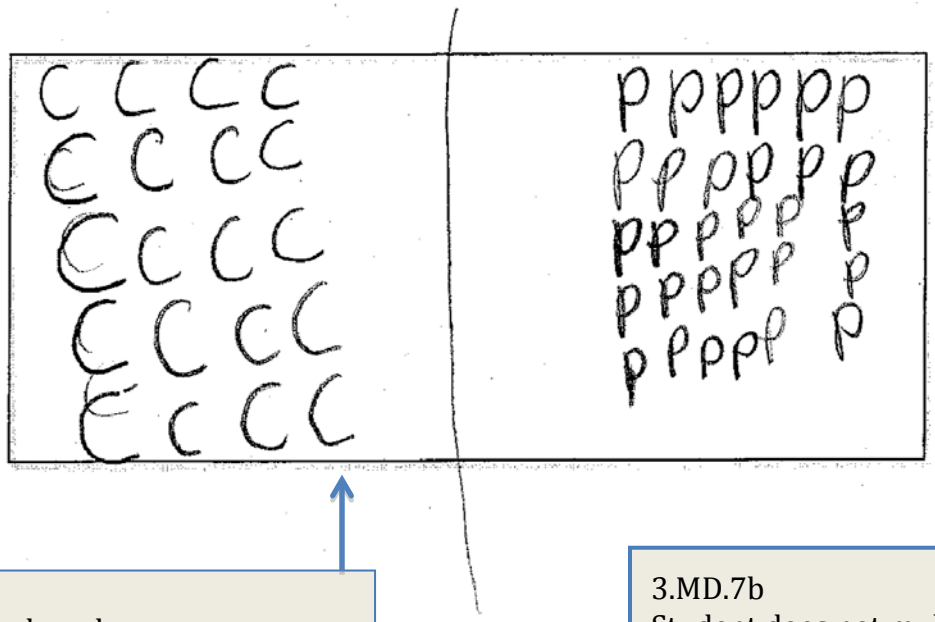
The school cafeteria worker would like to plant 5 rows of vegetables, in a sequence of 4 heads of cabbage followed by 6 potatoes in each row. Showing your work, explain how many total vegetables will grow this winter.

Draw the garden in the space provided. **Label** the cabbage patch and the potato patch.

3.MD.7d
Student does not use area as an additive to find total number of vegetables planted. Student did not show work.

3.MD.7c
Student does not use distributive property to find total number of vegetables planted. Student did not show work.

School Garden



The student demonstrates an understanding of decomposed areas within a larger area.

3.MD.7b
Student does not multiply side lengths to find the area of the vegetable plot (total number of vegetables).

Tomato Seed Packet	Carrot Seed Packet	Lettuce Seed Packet	Corn Seed Packet
Require 2 square units per seed	Require 2 square units per seed	Require 2 square units per seed	Require 2 square unit per seed

3. A new garden layout is designed. Class Y and Class Z make posters explaining how many vegetable seeds can be planted. Using the seed packet information, which class is right?

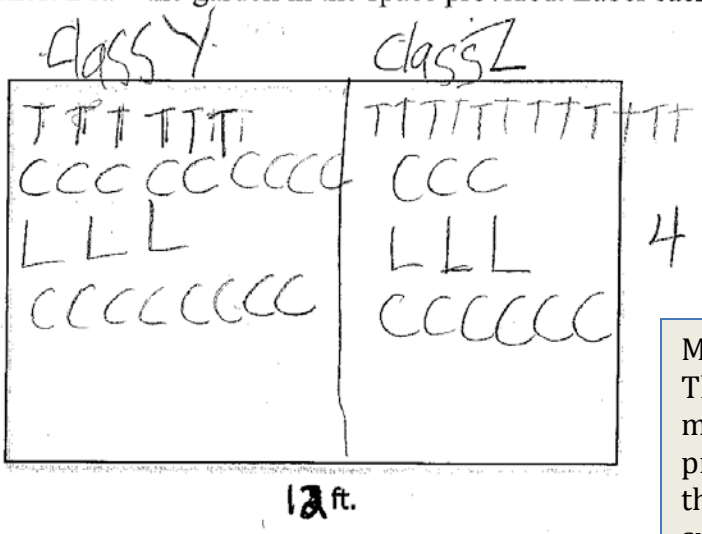
Seeds Planted

CLASS Y POSTER	
TOMATOES	6
CARROTS	9
LETTUCE	3
CORN	8

CLASS Z POSTER	
TOMATOES	12
CARROTS	3
LETTUCE	3
CORN	6

MP.3
The student does not justify response or show work to explain which class is right.

Show and explain how the correct Class Poster garden plot can be partitioned into four vegetable patches. Draw the garden in the space provided. Label each vegetable patch.



The student did not use the key information on the seed packets to calculate the amount of vegetables required for each class plan.

MP.1
The student did not make sense of the problem and realize that there is only enough space for one class plan to fit in the school

MP.4 and 3.MD.5b
The amount of vegetables illustrated in the figure does not match the 4x12 dimensions of the school garden. There are gaps in the rows of lettuce and corn and overlapping of units in the tomato row.

Grade 3 Math: City Farmers
Annotated Student Work: Level 1

Implications for Instruction

Students need to re-check work for reasonableness and accuracy. To help students who struggle with making tally marks and counting, we recommend providing different color pencils to aid with visual perception. The use of manipulatives and sticky notes are an additional resource to help students calculate for area.

Third graders should evaluate their results in the context of the situation and reflect on whether the results make sense. Therefore, checklists for the steps required in solving a word problem are encouraged during the unit. Furthermore, partner talks and small group work are recommended to guide inquiry and explain mathematical thinking. If a problem is solved incorrectly, opportunities should be given for the struggling student to re-explain in his/her own words how a classmate explained he/she solved for the problem correctly.

More instructional emphasis should be placed on finding and understanding why a representation makes sense, than merely finding the answer to problems in context.

COMMON CORE-ALIGNED TASK
WITH INSTRUCTIONAL SUPPORTS

Mathematics

Grade 3 Math: City Farmers

INSTRUCTIONAL SUPPORT FOR TEACHERS

The instructional supports on the following pages include a unit outline with lesson plans as it relates to Universal Design for Learning, a guide to cognitive complexity using Webb's Depth of Knowledge, an initial assessment, three formative assessments, and suggested learning activities. Teachers may use this unit outline as it is described, integrate parts of it into a currently existing curriculum unit, or use it as a model for upgrading a currently existing unit on a different topic.

Grade 3 MATH: City Farmers

UNIT TOPIC AND LENGTH

This instructional unit should run approximately 25 standard periods of instruction. Class periods will involve review the following activities: lessons on perimeter and counting same-size squares to find area (1 period), the pre-assessment entitled *Tulips and Daisies* (.25 period), lessons introducing area and square units (3 periods), class field trip to an urban garden i.e., the Brooklyn Botanic Gardens (1 period), lessons on tiling and how to use multiplication within rectangular arrays to find area (4 periods), the formative assessment entitled *Ms. Smith's Class Planting Predicament* (.5 period), lessons on distributive property to find area (4 periods), the formative assessment entitled *Winter Vegetables* (.5 period), lessons on finding unknown side lengths to solve for perimeter and area in real-world problems (4 periods), the formative assessment entitled *Fencing the Gardens* (.5 period), opportunities to draft and edit a garden plan (4 periods), hands-on garden construction activity and presentation (3 periods), instructional unit review (1 period), and the final performance task entitled *City Farmers* (1 period).

COMMON CORE CONTENT STANDARDS

3.MD.5 Recognize area as an attribute of plane figures and understand concepts of area measurement.

a. A square with side length 1 unit, called "a unit square," is said to have "one square unit" of area, and can be used to measure area.

b. A plane figure which can be covered without gaps or overlaps by *n* unit squares is said to have an area of *n* square units.

3.MD.6 Measure areas by counting unit squares (square cm, square m, square in, square ft, and improvised units).

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.

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

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.

3.MD.8 Solve real world and mathematical problems involving perimeters of polygons, including finding the perimeter given the side lengths, finding an unknown side length, and exhibiting rectangles with the same perimeter and different areas or with the same area and different perimeters.

Mathematical Processes

MP.1 Make sense of problems and persevere in solving them.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.

Context

This unit falls within the 2nd half of the school year. It will be introduced after Multiplication & Division and Fractions & Geometry. In order for this unit to be introduced, students must have been exposed to multiplication and division and some basic geometry, and have a basic knowledge of perimeter and shapes.

BIG IDEAS/ENDURING UNDERSTANDINGS

Students will understand:

- The relationship between finding rectilinear area and multiplication/addition
- How to deconstruct a rectilinear space into non-overlapping rectangles to find the area of the entire space
- How to connect mathematical expression to word problems
- How to justify the use of space to create area through mathematical expressions

ESSENTIAL QUESTIONS

- What is area?
- How is finding the area of a quadrilateral related to multiplication and addition?
- How can we express the area of a quadrilateral in a numerical expression?
- Why is calculating area important to us in our everyday life?
- How can we find the area of a rectilinear space that incorporates multiple rectangles?

CONTENT

- Mathematics is the focus subject of this task, specifically the measurement of area as it relates to multiplication.

Key concepts that will be covered:

- Measurement: measuring area using tiles and multiplication.
- Number Operations: relating area to multiplication (length x width).

SKILLS

- Students understand that area is the amount of surface inside a two-dimensional figure. (3.MD.5)
- Students understand that there are two ways to find the area of a square or rectangle:
  - Count the number of squares/tiles of a certain size that cover the inside of a

• Geometry: exploring the area of shapes, such as rectangles and squares.	shape. (3.MD.6) • Multiply side lengths *a* x *b* to find the area. (3.MD.7a) ➢ Students use tiles to find the area of a square or rectangle by finding the total number of same-size tiles that cover the shape. (3.MD.6) ➢ Students use tiles to create rectangular arrays that show a specific area. (3.MD.7a) ➢ Students use tiles to show that the area of a rectangular array is the same as would be found by multiplying the side lengths. (3.MD.7a) ➢ Students use tiles to find the area of a rectangle when provided with the side lengths, within the context of a word problem. (3.MD.7b) ➢ Students use tiling to give possible side lengths of a rectangle given the area, within the context of a word problem. (3.MD.7b) ➢ Students solve real-life problems related to area using multiplication and division (without tiles). (3.MD.7b) ➢ Students use area models to show the distributive property of two rectangles. (3.MD.7c)
MATH VOCABULARY ➢ Review: rows, columns, sides, rectangle, same-size square, sequence, measurement, ruler, yardstick, length ➢ area ➢ perimeter ➢ arrays ➢ side lengths ➢ grid ➢ partition ➢ unit square ➢ surface ➢ multiplication ➢ square feet ➢ square inches ➢ square centimeters	**GARDEN VOCABULARY** ➢ garden, gardener ➢ plant bed ➢ plot ➢ vegetable patch ➢ garden map ➢ fencing ➢ grid ➢ planting space ➢ pathway ➢ harvest ➢ seeds, seedlings ➢ to plant ➢ record ➢ soil

- tile, tiling
- distributive property

ASSESSMENT EVIDENCE

INITIAL ASSESSMENT:

In week one, the unit begins with the performance task entitled *Tulips & Daisies*. The task is designed to measure students' prior knowledge and skill in partitioning a rectangle into rows and columns of same-size squares, and counting to find the total number of squares (2.G.2). Students are asked to solve for the unknown in a word problem using addition and subtraction within 100 (2.OA.1) when given a rectangular array up to 5 rows and up to 5 columns (2.OA.4). Students are also asked to demonstrate their proficiency in measuring lengths of a polygon with a drawing of a ruler (2.MD.1) and find perimeter of a polygon in a word problem (2.MD.5). This task should be administered at the start of the unit. Most students will complete the task in 10-15 minutes, although time should not be a factor. Please reference *Tulips & Daisies* for full details.

FORMATIVE ASSESSMENT:

Students will participate in developing a unit-long project entitled *Garden Plan Project*. Students will design a garden plan (in weeks 1-4) using the provided activity worksheets #1-3, and students will work with the classroom teacher to edit/refine their plans. Student-teacher conferencing will take place every Friday, following the formative assessment. Feedback will be provided to students and recorded on a conference sheet entitled Garden Plan Checklist. In week five, students will have the opportunity to bring their garden plans to life by using real-world garden tools to measure the perimeter, partition the plot into rows and columns, determine the number of seeds within each unit square, calculate the area both by counting unit squares and multiplying side lengths, and physically construct garden spaces in aluminum pans. Students will then have an opportunity to share and defend their garden plan; the opportunity will also be given for students to critique the reasoning of others. Lastly, students will organize all of the individual gardens into one large class garden giving the students the opportunity to visually and tactilely reinforce the concept of area as additive; students will then reason through real-world problems to use distributive property to find the area of select plots. Please reference the *Garden Plan Project* for full details.

In week two, teachers would use the formative assessment entitled *Ms. Smith's Class Planting Predicament*. Students are asked to find the area of four plots by multiplying side lengths (3.MD.7b) and finding the total area of the garden by adding the areas of non-overlapping parts (3.MD.7d). Students are then asked to tile the garden map without gaps (3.MD.5b) to find the area of the entire space (3.MD.7a). Most students will complete the task in 15-20 minutes, although time should not be a factor. Please reference *Ms. Smith's Class Planting Predicament* for full details.

In week three, teachers would use the formative assessment entitled *Winter Vegetables*. When given the side lengths of two connecting vegetable patches, students are asked to sketch and label a garden map using tiling to show distributive property, and they also must explain their

mathematical reasoning of how they found and confirmed the larger area (3.MD.7c, 3.MD.7b). Most students will complete the task in 15-20 minutes, although time should not be a factor. Please reference *Winter Vegetables* for full details.

In week four, teachers would use the formative assessment entitled *Fencing the Gardens*. Students are asked to first use addition to count the total number of unit squares and to verify their answer through multiplication (3.MD.6, 3.MD.7a). Next, they are asked to solve a real world problem involving rectangular gardens with the same perimeter and different areas; students must determine an unknown side length to solve for area for entire garden (3.MD.8). Most students will complete the task in 15-20 minutes, although time should not be a factor. Please reference *Fencing the Gardens* for full details.

FINAL PERFORMANCE TASK:

In week five, teachers will use the final performance assessment entitled *City Farmers*. This task should be administered at the end of the unit. In the first problem, students must solve for an unknown side length of a garden (3.MD.8) and calculate the area of three different garden plots (3.MD.7b). Then, students are expected to solve a real-world problem by exhibiting different perimeters and areas by justifying why a garden plan with the largest number of flowers and least amount of fencing should be chosen (3.MD.8). In the second problem, students understand concepts of area measurement when interpreting and using the seed packet information appropriately to demonstrate knowledge of a "unit square" (3.MD.5a, 3.MD.5b). Students are then asked to find the area of a garden through multiplication and then determine the side lengths in a real world problem (3.MD.7a, 3.MD.7b). They relate area as additive when adding the areas of non-overlapping plant beds to figure out the area for the whole garden (3.MD.7d). In the third problem, students measure area by counting the unit squares representing a bed of lettuce (3.MD.6). They are also able to demonstrate an understanding of area by multiplying the side lengths of the garden (3.MD.7b). Finally, students must demonstrate understanding of area using the distributive property when partitioning the garden in their garden layout (3.MD.7c) and then adding the decomposed figures to find the total area (3.MD.7d). An opportunity for mathematical practices 1, 3, and 4 are presented when students monitor and evaluate their progress, critique the reasoning of garden plans and garden posters, and model mathematics by using geometry to solve a garden design problem. Most students will complete the task in approximately 30 minutes, although time should not be a factor. Please reference *Garden Arrays* for full details.

LEARNING PLAN & ACTIVITIES

Educators will be provided with detailed task bundle components that include a task description, pre-assessment, weekly activities/lessons, weekly assessments, a template for students to design and construct a garden-planting project, and a final assessment. Teacher notes, rubrics, and student work with commentary will also be included to direct educators. The Common Core standards chosen have been unpacked and the necessary skill that is a result of each standard has been included to guide instruction.

Students will demonstrate their understanding of multiplication and arrays throughout the task

process. Daily/weekly morning math messages will allow for teachers to observe students' acquisition of specific skills needed to complete the task. Students will be given daily homework that will reflect the skill for the day, and should be asked to think about that skill in a framework outside of the classroom. Throughout the unit, teacher observations will be used as informal assessments to ensure that each skill has been mastered successfully. Periodic assessments will be administered prior to the final test/task to provide timely feedback to teachers and students. For students that need more adult or manipulative support, quizzes may be administered orally and documented by a teacher.

Students will be asked to reflect on their own work throughout the learning process. On a daily basis, students will complete in-class activities that require them to show and explain their work. During these activities, students will be given the opportunity to explain their approach and findings. Through this process, teachers will be able to guide students through appropriate and effective reflection. (For example, if the length is 4 and the width is 3 and the student has the area as 15, the teacher can ask the student to show with the tiles how he or she found that answer.) By incorporating this self-assessment into the task, students will understand the importance of reviewing their own work for errors and will become comfortable with finding and fixing them.

Learning Progressions for the Common Core State Standards in Mathematics

Grade 2
In second grade, students learn to measure length with a variety of tools, such as rulers, meter sticks, and measuring tapes (2.MD.1). Second graders also learn the concept of the inverse relationship between the size of the unit of length and the number of units required to cover a specific length or distance (2.MD.2). Students learn to combine and compare lengths using arithmetic operations. That is they can add two lengths together to obtain the length of the whole and subtract one length from the other to find the difference in length (2.MD.4). Students might use addition and subtraction within 100 to solve word problems involving lengths that are given in the same unit.

To learn area concepts and skills meaningfully in later grades, students need to develop the ability known as *spatial structuring.* Students need to be able to see a rectangular region as decomposable into rows and columns of squares. This competence is discussed in detail in the Geometry Progression, but is mentioned here for two reasons. First, such spatial structuring precedes meaningful mathematical use of the structures, such as determining area or volume. Second, Grade 2 work in multiplication involves work with rectangular arrays (2.G.2), and this work is an ideal context in which to simultaneously develop both arithmetical and spatial structuring foundations for later work with area.

Grade 3
Third graders focus on solving real-world and mathematical problems involving perimeters of polygons (3.MD.8). Students then find unknown side lengths in more difficult missing measurement problems and other types of perimeter problems. Grade 3 students understand concepts of area and relate area to multiplication and to addition. Students learn formulas to compute area, with those formulas based on, and summarizing, a firm conceptual foundation about what area is. Students need to learn to conceptualize area as the amount of two-dimensional space in a bounded region and to measure it by choosing a unit of area that is

often a square (3.MD.5). Students learn to compose and decompose geometric regions. To begin an explicit focus on area, teachers might ask students which of three rectangles covers the most area. Students may first solve the problem with decomposition (cutting and/or folding) and re-composition, and eventually analyses with area-units.

Grade 4

In fourth grade, students look at perimeter and area of rectangles more abstractly based on work in previous grades with multiplication and structuring arrays by utilizing a formula for the area of a rectangle (4.MD.3). At this stage working with perimeter and area of rectangles is still grounded in specific visualizations and numbers. Students can make a transition from showing all length units along the sides of a rectangle or all area units within (as in third grade) by drawing a rectangle showing just parts of these as a reminder of which kind of unit is being used. Writing all of the lengths around a rectangle can also be useful.

In fourth grade and later grades where rectangle perimeter and area problems may become more complex, students learn to apply these understandings using formulas to solve real-world problems. When engaging in the mathematical practice of reasoning abstractly and quantitatively (MP.2) in work with area and perimeter, students think of the situation and can make a drawing. Then they recreate the formula with specific numbers and one unknown number as a situation equation for this particular numerical situation. By repeatedly reasoning about constructing situation equations for perimeter and area involving specific numbers and an unknown number, students will build a foundation for applying area, perimeter, and other formulas by substituting specific values for the variables in later grades.

RESOURCES

Mentor Texts & Materials: *Spaghetti and Meatballs for All!* by Marilyn Burns

http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=15&ved=0CGAQFjAEOAo&url=http%3A%2F%2Fdifferentiationcentral.com%2Fexamples%2FG4_Area_and_Perimeter_Unit.pdf&ei=4yKYT_nMD_KI6AHY7JXiBg&usg=AFQjCNEcK2zHjoPROiav6a_8NY506z3Gag&sig2=w4roxTYKZ_VmV0U5EAUOEw (page 9)

Class Field Trip Example: Brooklyn Botanic Gardens (free admission for children under 12)

Suggested manipulatives: graph paper, geoboards, and varied sizes of (1) colored tiles, (2) mosaics, (3) carpet tiles, (4) cubes/blocks, (5) beanbag squares, and (6) sticky notes

Materials Required for the Garden Plan Project: individual garden plan folder, graph paper, tiles, colored pencils, urban gardening seed packet information, activity worksheets #1-3, garden plan checklist, final draft checklist, aluminum roasting pans varying in size, variety of vegetable and flower seeds, soil, popsicle sticks, string, and measuring tape or ruler

City Farmers

A Unit Guide to Cognitive Complexity

The Garden Plan Activity refers to all of the content & mathematical practice standards addressed in the instructional unit

- Relate mathematical concepts (area) to real-world applications, such as urban gardening
- Planning, revising, and designing the Garden Plan Activity extended thinking over five weeks
- Reasoning through required changes to the plan as new math concepts are introduced to find area
- Flexibility and responsiveness to the changes
- Applying one approach among many to solve a problem (justify why the approach was used)
- Reporting a plan and results of data to peers
- Critiquing garden plan designs of others
- Creating a garden plot developed from the revised plan (after feedback from teacher and peers)
- Determining how to organize class garden by adding individual student gardens
- Making connections between phenomena observed

3.MD.5: Sing & memorize "What is Area" song to be able to define domain-specific vocabulary terms
3.MD.5a Use various manipulatives (i.e. 2x2 post-it notes or 1x1 colored tiles) to tile a student desk
3.MD.5b Illustrate a garden map (without overlaps) on graph paper by recording what they see in the gardens
3.MD.6 Tile different rectangles using the same size tiles and counting the tiles to find area
3.MD.7a Count unit squares and multiply side lengths
3.MD.7b Apply multiplication formula l x w to find areas
3.MD.7c Identify distributive property in area (e.g. a garden composed of 3x2 plot of yellow tulips next to a plot of 2x4 red roses)
3.MD.7d Add the rectangles of non-overlapping parts
3.MD.8 (1) Color the perimeter and area of 2D figures using different colors to represent perimeter and area (2) Calculate perimeter and area in an equation
MP.1 Use concrete objects and pictures to conceptualize meaning of the problem
MP.3 Ask and answer "Why is that true?" and reference drawings and concrete objects in response
MP.4 Use illustrations, objects, and calculations alone

Level 4
Extended Thinking

Level 1
Recall & Reproduction

Depth of Knowledge

Level 3
Strategic Thinking

Level 2
Basic Application

3.MD.5a Draw conclusions from field trip observations at an urban garden as it relates to one square unit of area within a given plot
3.MD.5b Explain how changes in dimensions (i.e. unit squares) affect the area
3.MD.6 Make conjectures about counting to find area and assess it as a method to solve for area
3.MD.7a Explain phenomena in terms of concepts
3.MD.7b Make conjectures about using multiplication to find area and assess it as a method to solve for area
3.MD.7c Formulate a mathematical expression for distributive property in the context of a real-world problem & explain mathematical thinking
3.MD.7d Determine multiple strategies to recognize area as additive in the context of a problem
3.MD.8 Interpret data of gardens with different areas and perimeters and draw conclusions about which is "bigger"
MP.1 Show multiple ways to confirm response and explain strategies of others who tried different approaches
MP.3 Explain misconceptions in the critique of others
MP.4 Explain the connections between multiple methods of modeling & evaluate results

3.MD.5a Compare the number of square units used to tile a student desk (various manipulatives, e.g. 2x2 post-it notes or 1x1 colored tiles)
3.MD.5b Partition area into rows and columns to make non-overlapping unit squares and describe process
3.MD.6 Estimate area and count unit squares or improvised units to solve for area
3.MD.7a Compare relationships between counting and multiplying
3.MD.7b Solve a multi-step word problem involving multiplying side lengths to find a product for area
3.MD.7c Use models to represent distributive property in area
3.MD.7d Decompose rectangles into non-overlapping rectangles and compare the parts to the whole
3.MD.8 Organize and display data for perimeter and area in a table or chart
MP.1 Use a different method to check thinking and asking themselves "Does this make sense?"
MP.3 Justify thinking and respond to thinking of others using refined verbal and/or written communication skills
MP.4 Create a chart, graph, or table to model mathematics or act out the problem

Weekly Lesson Plan Support

- [ ] Week One: Grade 2 Review & Introduction to Area and Unit Square

Standard(s) introduced this week: 3.MD.5a, 3.MD.5b

- [ ] Week Two: Tiling & Multiplication within Rectangular Arrays

Standard(s) introduced this week: 3.MD.6, 3.MD.7a, 3.MD.7d

- [ ] Week Three: Using Distributive Property to Find Area

Standard(s) introduced this week: 3.MD.7a, 3.MD.7b, 3.MD.7c

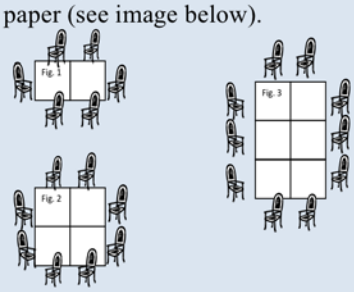
- [ ] Week Four: Finding Unknown Side Length to Solve for Perimeter & Area in Real-World Problems

Standard(s) introduced this week: 3.MD.8

- [ ] Week Five: Unit Review, Garden Plan Presentation, & Final Performance Task

Week One

Grade 2 Review & Introduction to Area and Square Unit

Day 1	**Objective: Students will take an Initial Assessment*:* <u>Tulips & Daisies</u>** Following the assessment, the teacher will introduce perimeter and area through literature and constructivist learning. The teacher will read the story *Meatballs for All* by Marilyn Burns and model his/her thinking by drawing the table and chair figures on a projected sheet of graph paper (see image below).  Teacher will think-aloud during read-aloud and ask the following questions in a whole-group discussion: ▪ DOK Level 1: How many tables are put together now? How many tables were added? How many seats did they gain? Do they have enough seats? How many more seats do they still need? ▪ DOK Level 2: What is the sum of all the side lengths in this table? How does that answer compare to the previous table? How many people can sit at each table now? How does this compare with previous table? ▪ DOK Level 3: Why didn't adding two more tables make it so six people could sit at the table? Would it help if they added tables to the ends, making a long line instead of a square? Why or why not? Will adding two more tables (for a total of six tables) solve the problem? Why or why not? Is there any way to add tables and gain more than two seats (while keeping the shape of rectangle)? *This lesson is adapted from a unit plan designed by Adam Hoppe of UVA (to access the online lesson, please reference the resources section below).
Day 2	**Objective: Students will review 2nd grade standards tested on the Initial Assessment. Then, students will understand that area is the amount of surface inside a two-dimensional figure (3.MD.5a, 3.MD.5b). Students will understand the concept of area before being asked to measure it.** ▪ Review the following standards: 2.OA.1, 2.OA.4, 2.G.2, 2.MD.1, 2.MD.5 ▪ Teacher models the area of 2D figures by using an overhead or whiteboard with color markers. Teacher shows the perimeter with a black marker and colors the area green. Students will then practice coloring the perimeter and area of 2D figures using different colors to represent perimeter and area. ▪ Sing-a-long Activity- Student will listen to and sing the following songs to the tune of jingle bells: "What is Area?" & "What is perimeter?" (www.proteacher.org)
Day 3	**Objective: Students will identify a square with side length 1 unit; they will define a unit square as 1 square unit of area that can be used to measure the area of larger squares and rectangles (3.MD.5a).** ▪ Teacher uses drawing on chart to show that 1 unit is called a unit square. The teacher uses the same-size square unit to show that the area of a unit square is 1 square unit. The next step will show how the students can use square units to find the area of larger squares and rectangles. ▪ Students will use various manipulatives (i.e. 2x2 post-it notes or 1x1 colored tiles) to tile a student desk. One group will use a larger size of same-size square units, and a second group will use a smaller size of same-size square units to fill the area of the desk. Teacher will ask the following question: "All groups used the same amount of desk space, why did groups use a different number of unit squares?"

Day 4	**Objective: Students will participate in Project-Based Learning** ▪ Students will take a class field trip to an urban farm, i.e. Brooklyn Botanic Gardens (free admission for children under 12). Garden vocabulary will be introduced, and math vocabulary (area, unit square, perimeter) will be reviewed during the field trip. Students will identify a plot as a unit of area. Students will practice drawing a garden map on graph paper by recording what they see in the gardens; students will outline the perimeter in black and shade the area in green. Students will estimate the side lengths, determine the unit length of each unit square on map, and then calculate the perimeter.
Day 5	**Objective: Students will begin the unit-project. Please reference the <u>Garden Plan Project</u> for full details.** ▪ The teacher will explain that each student will be creating a garden plan that we will work on throughout our City Farmers unit. The teacher will provide students with the **Urban Gardening Seed Packet Information.** Each student will decide which type of plant that they will grow to contribute to the class garden. At this point the teacher will explain that certain seeds need a specific amount of area to grow. The teacher will review which plants need what amount of area and demonstrate how the students can find this information. The teacher will then assign **Garden Plan Activity #1**. There should be three groups of students, A, B, and C, depending on the initial assessment results. Students will either work in one of two small work groups with supervision or independently. The students will be directed to use tiles and the activity sheet to create a garden plan in which they can grow their vegetables. The students must take into account the area that each seed will need. The area of their garden plan cannot be any larger than the size of the activity 1 paper. Students will use tiles to draw their garden. Students will then use tiling to find area. Students in Group A will be provided with a worksheet that contains a graph and adult support. Students in Group B will not be provided with a graph but will receive adult supervision. Group C will work independently. ▪ Students will be given an opportunity to share their garden plan with the entire class. Students will reflect on how tiling was used to find the area.

Universal Design for Learning

Representation	Action & Expression	Engagement
• Provide written transcripts for audio recording of songs • Use of touch equivalents (tactile objects or vibrations) to emphasize key concept of unit area • Provide graphic symbols with alternative text descriptions when pre-teaching vocabulary • Create a Task Word Wall that will be accessible to the students throughout the task • Make connections to previously learned structures • Employ the use of video clips, pictures and/or magazines to aid in understanding of the concept of a garden and how gardens can have different uses (flowers or vegetables)	• Use different types of manipulatives and have students become familiar with them prior to the task • Provide pre-formatted graph paper • Provide sentence starters for students explaining mathematical thinking • Embed prompts to "show and explain your work" • Provide templates for data collection on field trip	• Allows learners to participate in the design of academic tasks (i.e. Garden Plan) • Involve all participants in whole class discussions • Differentiate the degree of difficulty within core classroom activities • Create expectations for group work (i.e. norms and review project rubric)

Week Two

Tiling and Multiplication Within Rectangular Arrays to Find Area

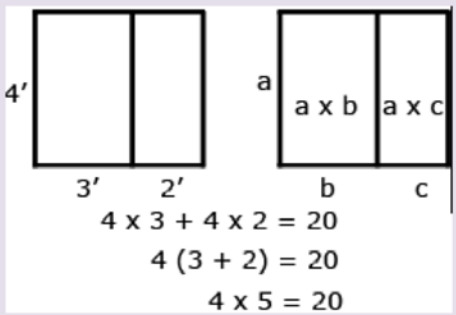
Day 1	**Objective: Review week 1 skills. Then students will use tiles to find the area of a square or rectangle by finding the total number of same-size tiles that cover the shape. (3.MD.6) Count the number of squares/tiles of a certain size that cover the inside of a shape. (3.MD.6)** ▪ Teacher models overhead or whiteboard to demonstrate how to find the area of a rectangle using the same size tiles. ▪ Students practice tiling different rectangles using the same size tiles and counting the tiles to find area. Students will practice tiling with real-world objects starting with large unit square area (i.e. window panes, stained glass squares on windows, and carpet square) and then transition to smaller unit square area (3 in. beanbag squares, 1 in. cube, or 1 cm. subway mosaic tiles).
Day 2	**Objective: Students will understand that there are two ways to find the area of a square or rectangle: one by one tiling and the other by multiplying side lengths a x b to find the area. (3.MD.7a)** ▪ The teacher models tiling to find area. Then the teacher shows how to count the tiles to find and label the side lengths. The teacher then demonstrates how to multiply the side lengths to find the area. ▪ Students practice tiling rectangles to find area and show how to multiply the side lengths to find area.
Day 3	**Objective: Given specific side lengths, students will use tiles to create rectangular arrays that show a specific area. (3.MD.7a, 3.MD.7b)** ▪ Teacher will model how to create rectangular garden arrays to show a specific area, labeling side lengths, and demonstrating multiplication facts. ▪ Students will practice creating garden arrays using information provided in key (instead of tiling). Students will find the side lengths by measuring inches of garden flats with a ruler, and they will use the measurements to compute the area of rectangular arrays
Day 4	**Objective: Given specific side lengths and areas, students will create rectangular garden arrays that show a specific area (3.MD.7a). Students will also recognize area as additive (3.MD.7d).** ▪ Teacher will review lesson from the previous day. Teacher will also model how different rectangles can fit into one larger space using different color tiles (i.e. blue tiles are daisies, red tiles are roses, yellow tiles are sunflowers, etc). Students will recognize that rectangular arrays have been made within the larger rectangular garden. ▪ The teacher will announce that there has been a change to the classroom garden space! "The Principal has decided that the amount of space from the previous week was too large and he/she will provide us with the size that each individual garden plan should be. The principal also decided that two different types of seeds should be planted in their new plan." The teacher will give the students a card with the side lengths of their revised garden plan. The students will work independently to find the area of their plan using multiplication. Students that struggle with fluency may use drawings or counters to find the answer. ▪ The students will then separate into their groups (A, B, C) and begin the **Garden Plan Activity #2**. All students will use graph paper and the new side lengths to confirm the area of their garden plan. Once the area of the garden plan is confirmed the students will separate their garden into two rectangles and find the area of these two rectangles. With the two areas the students will find two different seeds that could fit within these two areas. (Please reference the **Garden Plan Project** for full details.) ▪ Students will share their revised garden plans to the whole group and respond to the following questions: How did your garden change? What different skills did we use to find area? Why was it important to use different skills to find the area?

Day 5	**Objective: Review** ▪ Students will take the **Ms. Smith's Class Planting Predicament** assessment. ▪ Teacher- Student Conferencing (after students finish test): The students will work on completing their revised garden plans. The students will each conference with the teacher and review the area and their seed choices. The teacher will prompt students to think about whether or no the seeds they chose fit into the area given. The teacher will also discuss with the student what different skills they used to find the revised area.

Universal Design for Learning		
Representation	**Action & Expression**	**Engagement**
• Anchor instruction by linking to and activating relevant prior knowledge (e.g. by using visual imagery) • Vary display: color used for information (i.e. highlighting key concepts) and visual layout (i.e. colored tiles) • Identify the key words that may create confusion and have pictures and/or Mayer Johnson symbols that can aid in understanding • Create a Task Word Wall that will be accessible to the students throughout the task • Provide concept maps to support notetaking • Make connections to previously learned structures • Offer opportunities over time to revisit key ideas and linkages between ideas	• Reinforce basic multiplication skills and addition skills by having a multiplication chart or number line available • Provide alternatives in the requirements for range of motor action required to interact with instructional materials • Provide models that demonstrate the same outcome but use differing approaches to arriving at the correct answer • Provide sentence starters for students explaining mathematical thinking • Use virtual or concrete real-word manipulatives (i.e. 3 in. beanbag squares, 1 in. cube, 1 cm. subway mosaic tiles, window panes, stained glass squares on windows, and carpet square). • Provide pre-formatted graph paper, calculators • Provide alternatives for responding with pen and pencil on assessment • Show representation of progress (before and after photos)	• Provide learners with autonomy in the timing for completion of subcomponent of unit project • Vary the level of novelty: provide visible timers and cues • Involve all participants in whole class discussions • Include activities that foster the use of imagination to solve novel and relevant problems and reflect a purpose • Offer checklists for students to self-monitor their progress on the unit project • Provide feedback that emphasizes effort, improvement, and achieving a standard rather than on relative performance • Encourage peer interaction and support (i.e. student tutors)

Week Three

Using Distributive Property to find Area

Day 1	**Objective: Review Week 2 assessment and skills**
Day 2	**Objective: Students will use tiles to show that the area of a rectangular array is the same as would be found by multiplying the side lengths (3.MD.7a) Students will use tiles to find the area of a rectangle when provided with the side lengths, within the context of a word problem (3.MD.7b)** ▪ Teacher will model how to read a word problem and highlight key information to fill out a rectangular array. The whole class participates in a guided practice word problem. ▪ In small groups, students will practice word problems (same wording and different numbers) at various stations. Make sure you check your work! o Station #1: Students are given blocks to tile by counting unit squares to find the area o Station# 2: Students are only given the side lengths so they have to use multiplication to find the area o Station #3: Students are given a ruler to measure the side lengths and then compute to find the area ▪ Whole Group Questions: (1) Which station did you like the best? (2) Which methods did you use to solve the problem? (3) How did you come up with a group consensus and how did you check your work? (4) How do all of the methods compliment each other?
Day 3	**Objective: Students use tiles to show how to find area when side lengths can be added using the distributive property (3.MD.7c)**  ▪ Teacher will model the formula for area by showing two different ways to solve for area using distributive property. ▪ Students will practice with colored tiles to find larger area of two areas (i.e. red rectangle and blue rectangle) ▪ Questions: (1) What is going to be bigger, a (b +c) or ab + ac? Students will estimate before finding the answer. ▪ Students then practice finding the area using two ways to prove the answer for the larger area.

Day 4	**Objective: Using distributive property, students solve real-life problems related to area using multiplication, without tiles (3.MD.7b and 3.MD.7c). The students will use multiplication to find the area of a garden plot based on the space that each plant needs and the area given.** ▪ Teacher models his/her garden plan to explain how he/she would modify the current plan when given more space. ▪ The teacher introduces their garden plan project with an announcement: "You need to grow more of one type of seed in order for the cafeteria ladies to have enough flowers and vegetables for summer school!" **The Garden Plan Activity #3** will require students to add an additional garden bed. The teacher reminds students that they have been using distributive property to find unknown side-lengths that help us find the area. The teacher tells the students that they will use their understanding of distributive property to find the area of the additional space and the total area. The extension to the garden must share one side length with their garden plan. (Please reference **Garden Plan Project** for full details.) ▪ Students will work in their math groups (A, B, C) to add an extension to their garden plan. Group A will continue to use graph paper to plan their garden with adult supervision, Group B will only require supervision, and Group C will work independently. ▪ Students will share their revised garden plans to the whole group and respond the following questions: How did your garden change? What different skills did we use to find area? Why was it important to use different skills to find the area?
Day 5	**Objective: Review** ▪ Students will take the **Winter Vegetables** assessment. ▪ Teacher- Student Conferencing (after students finish the test): the students will work on completing their revised garden plans. The students will each conference with the teacher and review the revised area of their garden plan. The teacher will prompt students to think about the extension. The teacher will ask the students to describe how they found the area of the new space and how they found the new total area of the garden plan.

Universal Design for Learning

Representation	Action & Expression	Engagement
• Allow for flexibility and easy access to multiple representations of notation where appropriate (e.g. formulas) • Vary display: color used for information (i.e. highlighting key concepts) and visual layout (i.e. colored tiles for emphasis) • Embed visual, non-linguistic supports for vocabulary clarification • Make connections to previously learned structures • Offer opportunities over time to revisit key ideas and linkages between ideas • Present key concepts in one form of symbolic representation (i.e. equation) with an alternative form (i.e. animation, illustration, or virtual manipulative)	• Reinforce basic multiplication skills and addition skills by having a multiplication chart or number line available • Use virtual or concrete math manipulatives • Provide sentence starters for students explaining mathematical thinking • Provide pre-formatted graph paper, calculators • Provide alternatives for responding with pen and pencil on assessment • Show representation of progress (before and after photos) • Prompt learners to identify the type of feedback or advice they are seeking	• Provide learners with autonomy in the timing for completion of subcomponent of unit project • Vary the level of novelty: provide visible timers and cues • Involve all participants in whole class discussions • Include activities that foster the use of imagination to solve novel and relevant problems and reflect a purpose • Support activities that encourage self-reflection and identification of goals • Provide feedback that encourages perseverance, focuses on development of efficacy and self-awareness • Provide differentiated models for appropriately handling judgments (i.e. "how can I improve on the areas that I am struggling in?" rather than "I am not good in math"). • Encourage peer interaction and support (i.e. student tutors)

Week Four

Finding Unknown Side Lengths to Solve for Perimeter & Area in Real-World Problems

Day 1

Objective: Review Week 3 assessment and skills

Day 2

Objective: Students will understand the vocabulary term "perimeter" and review the concept of perimeter. Students will use understanding of perimeter to find the unknown side length of a rectangle (3. MD.8)

- Sing-a-long Review- Student will listen to and sing the following songs to the tune of jingle bells: "What is Area?" & "What is perimeter?" (www.proteacher.org)
- Students will measure the perimeter of the room, the teacher's desk, the chalkboard, favorite book, etc.
- Scavenger Hunt "I Spy": With a given list, students will find real-world objects that match the perimeter (i.e. I spy an object that has a perimeter of 24 inches. Can you find it in this box? How did you find your answer?)

Day 3

Objective: Students will find the unknown side length of a rectangle when given the perimeter or area (3.MD.8).

- Teacher will model how to use the perimeter to find lengths by "going backwards". "If the perimeter is 20 and we know that length "a" is 8 units, how do we find the length of side "*b*"?" (Opposite sides are equal, therefore two sides are 8, leaving 4 units left. 4 /2 sides equals 2 units per side).
- Students work in small groups through practice problems then move to independent practice.

Day 4

Objective: Using a math game, students will find the area of two rectangles that have the same total perimeter but with different side lengths. Students will find the different possible side lengths of rectangles with the same area. (3.MD.8).

- Teacher will model how to compare perimeter and area of a rectangle.
- Students will get into small groups to play "area/perimeter top-it." To play, students each draw one card containing a rectangle. Students then solve for area and perimeter for their own square. When every student has solved for area and perimeter, a student roles a die marked with A's and P's indicating which calculation will win. In the event that two students hold a card with the same greatest calculation, the student with the biggest second calculation wins. The winning student collects the cards and the next round begins.
- Extension Activity (from Arizona Standards unpacked document):
  "Students use geoboards, tiles, graph paper, or technology to find all the possible rectangles with a given area (e.g. find the rectangles that have an area of 12 square units.) They record all the possibilities using dot or graph paper, compile the possibilities into an organized list or a table, and determine whether they have all the possible rectangles. Students then investigate the perimeter of the rectangles with an area of 12.

Area	Length	Width	Perimeter
12 sq. in.	1 in.	12 in.	26 in.
12 sq. in.	2 in.	6 in.	16 in.
12 sq. in	3 in.	4 in.	14 in.
12 sq. in	4 in.	3 in.	14 in.
12 sq. in	6 in.	2 in.	16 in.
12 sq. in	12 in.	1 in.	26 in.

The patterns in the chart allow the students to identify the factors of 12, connect the results to the commutative property, and discuss the differences in perimeter within the same area. This chart can also be used to investigate rectangles with the same perimeter. It is important to include squares in the investigation."

Day 5	**Objective: Review** ▪ Students will take the **Fencing the Gardens** assessment. ▪ After the assessment, the students work on completing any part of their garden plan that has not been completed. The students will each conference with teacher. The teacher will edit the first three activities and provide feedback. The students will revise their plans and rewrite their **Garden Plan Activity #3** on final draft paper. The final drafts should include labeled clearly drawn plans, labeled side lengths, perimeters, areas, and color that distinguishes what they planted and a bold perimeter for each garden plan. Students will use a **Garden Plan checklist** and a **Final Draft checklist** to make sure they have all necessary components. (Please reference the **Garden Plan Project** for full details.)

Universal Design for Learning		
Representation	**Action & Expression**	**Engagement**
• Allow for flexibility and easy access to multiple representations of notation where appropriate (e.g. formulas) • Vary display: color used for information (i.e. highlighting key concepts) and visual layout (i.e. colored tiles for emphasis) • Embed visual, non-linguistic supports for vocabulary clarification • Make connections to previously learned structures • Offer opportunities over time to revisit key ideas and linkages between ideas • Present key concepts in one form of symbolic representation (i.e. equation) with an alternative form (i.e. animation, illustration, or virtual manipulative)	• Use virtual or concrete math manipulatives • Provide sentence starters for students explaining mathematical thinking • Provide pre-formatted graph paper, calculators • Provide alternatives for responding with pen and pencil on assessment • Show representation of progress (before and after photos) • Prompt learners to identify the type of feedback or advice they are seeking	• Provide learners with autonomy in the timing for completion of subcomponent of unit project • Vary the level of novelty: provide visible timers and cues • Involve all participants in whole class discussions • Include activities that foster the use of imagination to solve novel and relevant problems and reflect a purpose • Support activities that encourage self-reflection and identification of goals • Provide feedback that encourages perseverance, focuses on development of efficacy and self-awareness • Provide differentiated models for appropriately handling judgments (i.e. "how can I improve on the areas that I am struggling in?" rather than "I am not good in math"). • Encourage peer interaction and support (i.e. student tutors)

Week Five

Unit Review, Garden Plan Presentations, & Performance Task

Day 1	**Objective: Students will create their own garden areas using different size aluminum roasting pans, soil, and seeds (MP1, MP4). Please reference the <u>Garden Plan Project</u> for full details.** ▪ Students will measure the aluminum pan to find the side lengths ▪ Using string, students will create grids in plant bed to partition rows and columns into unit squares (3.MD.5a, 3.MD.5b) ▪ Students will calculate perimeter ▪ Students will calculate area by counting unit squares and multiplying side lengths to verify answer. Students will label the total area on a Popsicle Stick and mount it in the soil. (3.MD.6, 3.MD.7a, 3.MD.7b) ▪ Students will determine the total number of seeds needed ▪ Students will plant seeds in the garden (3.D.5b)
Day 2	**Objective: Students will present their unit-long projects. Please reference the Garden Plan Project for full details.** ▪ In small groups, students will present their garden plots and defend their garden plan through mathematical reasoning; classmates will critique the reasoning of others in the presentations (MP3) ▪ In a large group, students will discuss and explain how their classmates' plant beds with same perimeter have different areas and same areas have different perimeters (3.MD.8)
Day 3	**Objective: Students will build class garden and practice solving real-word problems (MP1, MP4). Please reference the Garden Plan Project for full details.** ▪ Using all of the various sized plant beds, students will figure out how they're going to organize the large class garden (3.MD.7d) ▪ Students will then relate area as an additive property by placing all the connecting beds and calculate the large area (3.MD.7d) ▪ After the garden is built, the teacher will choose two plots and ask students to practice finding area by using distributive property (3.MD.7c)
Day 4	**Objective: Formally review the Instructional Unit on Area**
Day 5	**Objective: Students will take the Final Performance Task entitled <u>Garden Arrays</u>**

Universal Design for Learning

Representation	Action & Expression	Engagement
• Vary display: color used for information (i.e. highlighting key concepts) and visual layout (i.e. colored tiles for emphasis) • Embed visual, non-linguistic supports for vocabulary clarification	• Use concrete real-world manipulatives • Provide sentence starters for students explaining mathematical thinking • Provide pre-formatted graph paper, calculators • Provide alternatives for responding with pen and pencil on assessment • Prompt learners to identify the type of feedback or advice they are seeking	• Involve all participants in whole class discussions • Include activities that foster the use of imagination to solve novel and relevant problems and reflect a purpose • Support activities that encourage self-reflection and identification of goals • Encourage peer interaction and support (i.e. student tutors)

Garden Plan Project:

Designing a Class Garden

Overview: Over the 5-week City Farmers instructional unit, students will design individual garden plans that will each occupy a class garden at the end of the unit. Students will demonstrate their knowledge of area and perimeter based on the knowledge of square units, partitioning, side-lengths, multiplication, distributive property, and area as additive. The students will show their understanding in their individual and class garden plans using mathematical reasoning.

Grade: 3

Duration/Length: 9-10 days over the course of 5 weeks. This includes the introductory lesson, student planning, teacher conferencing, garden construction, and presentations.

Garden Plan Alignment to the Common Core

Common Core Standards	Objectives & Hands-on Activities Linked to the Standards
3.MD.5 Recognize area as an attribute of plane figures and understand concepts of area measurement.	Students will create garden plans that demonstrate recognition of area as an attribute of plane figures.
3.MD.5a 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.	Students will compute in square units.
3.MD.5b 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.	Students will show that they can partition their garden into square units without gaps or overlapping, and count the square units partition to find the area.
3.MD.6 Measure areas by counting unit squares (square cm, square m, square in, square ft, and improvised units).	Students will measure their constructed gardens by counting the square units they found by partitioning.
3.MD.7 Relate area to the operations of multiplication and addition.	Students will show how they can find the area of their garden plan using addition and multiplication.
3.MD.7a 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.	Students will find the area of their garden plan by counting squares in a graph or with tiles.
3.MD.7b 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.	Students will multiply the side lengths of their garden plan to find area.
3.MD.7c 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.	Students will use distributive property to find the area of the class garden (when class garden is put together at the end of the unit).
3.MD.7d 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.	Students will check the area of the class garden by adding the area of each student's garden plan to find the total area of the class garden.
3.MD.8 Solve real world and mathematical problems involving perimeters of polygons, including finding the perimeter given the side lengths, finding an unknown side length, and exhibiting rectangles with the same perimeter and different areas or with the same area and different perimeters.	Students will adjust their garden plan to fit a specific area or perimeter.

Garden Plan Lessons & Activities

☐ **Week 1, Day 5**

- The teacher will explain that each student will be creating a garden plan that we will work on throughout our City Farmers unit. The teacher will provide students with the **Urban Gardening Seed Packet Information**. Each student will decide which type of plant that they will grow to contribute to the class garden. At this point, the teacher will explain that certain seeds need a specific amount of area to grow. The teacher will review which plants need what amount of area and demonstrate how the students can find this information. The teacher will then assign **Garden Plan Activity #1**. There should be three groups of students, A, B, and C, depending on the initial assessment results. Students will either work in one of two small work groups with supervision or independently. The students will be directed to use tiles and the activity sheet to create a garden plan in which they can grow their vegetables. The students must take into account the area that each seed will need. The area of their garden plan cannot be any larger than the size of the activity 1 paper. Students will use tiles to draw their garden. Students will then use tiling to find area. Students in Group A will be provided with a worksheet that contains a graph and adult support. Students in Group B will not be provided with a graph but will receive adult supervision. Group C will work independently.
- Students will be given an opportunity to share their garden plan with the entire class. Students will reflect on how tiling was used to find the area.

☐ **Week 2, Day 4**

- The teacher will announce that there has been a change to the classroom garden space! "The Principal has decided that the amount of space from the previous week was too large and he/she will provide us with the size that each individual garden plan should be. The principal also decided that two different types of seeds should be planted in their new plan." The teacher will give the students a card with the side lengths of their revised garden plan. The students will work independently to find the area of their plan using multiplication. Students that struggle with fluency may use drawings or counters to find the answer.
- The students will then separate into their groups (A, B, C) and begin the **Garden Plan Activity #2**. All students will use graph paper and the new side lengths to confirm the area of their garden plan. Once the area of the garden plan is confirmed the students will separate their garden into two rectangles and find the area of these two rectangles. The students will find two different seeds that could fit within these two areas. (Please reference the **Garden Plan Project** for full details.)
- Students will share their revised garden plans to the whole group and respond to the following questions: How did your garden change? What different skills did we use to find area? Why was it important to use different skills to find the area?

☐ **Week 2, Day 5**

- Teacher- Student Conferencing (after students finish the Ms. Smith's Planting Predicament Assessment): The students will work on completing their revised garden plans. The students will each conference with the teacher and review the area and their seed choices. The teacher will prompt students to think about whether or not the seeds they chose fit into the area given. The teacher will also discuss with the students what different skills they used to find the revised area.

☐ **Week 3, Day 4**

- The teacher introduces their garden plan project with an announcement: "You need to grow more of one type of seed in order for the cafeteria ladies to have enough flowers and vegetables for summer school!" **The Garden Plan Activity #3** will require students to add an additional garden bed. The teacher reminds students that they have been using distributive property to find unknown side-lengths that help find the area. The teacher tells the students that they will use their understanding of distributive property to find the area of the additional space and the total area. The extension to the garden must share one side length with their garden plan. (Please reference **Garden Plan Project** for full details.)
- Students will work in their math groups (A, B, C) to add an extension to their garden plan. Group A will continue to use graph paper to plan their garden with adult supervision, Group B will only require supervision, and Group C will work independently.
- Students will share their revised garden plans with the whole group and respond to the following questions: How did your garden change? What different skills did we use to find area? Why was it important to use different skills to find the area?

☐ **Week 3, Day 5**

- Teacher- Student Conferencing (after students finish the Winter Vegetables Assessment): The students will work on completing their revised garden plans. The students will each conference with the teacher and review the area and their seed choices. The teacher will prompt students to think about whether or not the seeds they chose fit into the area given. The teacher will also discuss with the students what different skills they used to find the revised area.

☐ **Week 4, Day 5**

- After the Fencing the Gardens assessment, the students work on completing any part of their garden plan that has not been completed. Each student will conference with the teacher. The teacher will edit the first three activities and provide feedback. The students will revise their plans and rewrite their **Garden Plan Activity #3** on final draft paper. The final drafts should include clearly labeled drawn plans, labeled side lengths, perimeters, areas, and color that distinguishes what the students planted and a bold perimeter for each garden plan. Students will use a **Garden Plan checklist** and a **Final Draft checklist** to ensure they have all necessary components. (Please reference the **Garden Plan Project** for full details.)

☐ **Week 5, Day 1**

Students will create their own garden areas using different size aluminum roasting pans, soil, and seeds.

- Students will measure the aluminum pan to find the side lengths.
- Using string, students will create grids in a plant bed to partition rows and columns into unit squares. (3.MD.5a, 3.MD.5b)
- Students will calculate perimeter.
- Students will calculate area by counting unit squares and multiplying side lengths to verify answer. Students will label the total area on a Popsicle Stick and mount it in the soil. (3.MD.6, 3.MD.7a, 3.MD.7b)
- Students will determine the total number of seeds needed.
- Students will plant seeds in the garden. (3.D.5b)

☐ **Week 5, Day 2**

Students will present their unit-long projects.

- In small groups, students will present their garden plots and defend their garden plan through mathematical reasoning; classmates will critique the reasoning of others in the presentations (MP3)
- In a large group, students will discuss and explain how their classmates' plant beds with same perimeter have different areas and same areas have different perimeters (3.MD.8)

☐ **Week 5, Day 3**

Students will build class garden and practice solving real-word problems.

- Using all of the various sized plant beds, students will figure out how they're going to organize the large class garden (3.MD.7d)
- Students will then relate area as an additive property by placing all the connecting beds and calculate the large area (3.MD.7d)
- After the garden is built, the teacher will choose two plots and ask students to practice finding area by using distributive property (3.MD.7c)

Urban Gardening:
Seed Information Packets

Collard Greens Seed Packet
Requires 2 square units per seed

Carrot Seed Packet
Requires 2 square units per seed

Lettuce Seed Packet
Requires 3 square units per seed

Corn Seed Packet
Requires 1 square unit per seed

Daisies Seed Packet
Requires 1 square unit per seed

Sunflowers Seed Packet
Requires 2 square units per seed

Morning Glories Seed Packet
Requires 4 square units per seed

Poppies Seed Packet
Requires 1 square unit per seed

Gardener Name: _____

Date: _____

Garden Plan Activity #1

Use tiles to create your own rectangular garden plan! Record the seed information below. Make sure your seeds have the area they need!

Seed type: _____
Area needed per seed: _____
Total area of garden plan: _____
Number of seeds to be planted: _____

Gardener Name: _____

Date: _____

Garden Plan Activity #1 with Graph Paper

Use tiles to create your own rectangular garden plan! Record the seed information below. Make sure your seeds have the area they need!

Seed type: _____
Area needed per seed: _____
Total area of garden plan: _____
Number of seeds to be planted: _____

Garden Plan Activity #2

1. New side lengths:_____, _____ Area with multiplication: _____
2. Draw side lengths on graph. Area counting units: _____
3. Create two rectangles in plan. Area of rectangles: _____ +_____ =
4. Which two seeds could you grow? How many seed could be planted in each rectangle?

_____

_____

Garden Plan Activity #3

1. Draw previous garden plan.
2. Add extension. The extension should share one whole side length with the previous garden plan.
3. Label all side lengths.

4. What is the area of the new garden plan? _____
5. What is the total area of the garden plan? _____

Garden Plan Activity #3 with Graph Paper

1. Draw previous garden plan.
2. Add extension. The extension should share one whole side length with the previous garden plan.
3. Label all side lengths.
4. What is the area of the new garden plan? _____
5. What is the total area of the garden plan? _____

Garden Plan Checklist

Activity	Student: Check If Completed	Teacher Observations	Next Steps
Garden Plan Activity #1			
Garden Plan Activity #2			
Garden Plan Activity #3			
Final Draft of Garden Plan #3			

Garden Plan Final Draft Checklist

Plan Component	Student: Check If Completed	Teacher Observations	Next Steps
Labeled Side Lengths			
Total Area			
Total Perimeter			
Color for Perimeter and Seeds Planted			

COMMON CORE-ALIGNED TASK
WITH INSTRUCTIONAL SUPPORTS

Mathematics

Grade 3 Math: City Farmers

INITIAL ASSESSMENT

Tulips & Daisies

In week one, the unit begins with the performance task entitled *Tulips & Daisies*. The task is designed to measure students' prior knowledge and skill in partitioning a rectangle into rows and columns of same-size squares, and counting to find the total number of squares (2.G.2). Students are asked to solve for the unknown in a word problem using addition and subtraction within 100 (2.OA.1) when given a rectangular array up to 5 rows and up to 5 columns (2.OA.4). Students are also asked to demonstrate their proficiency in measuring lengths of a polygon with a drawing of a ruler (2.MD.1) and find perimeter of a polygon in a word problem (2.MD.5). This task should be administered at the start of the unit. Most students will complete the task in 10-15 minutes, although time should not be a factor.

Tulips & Daisies

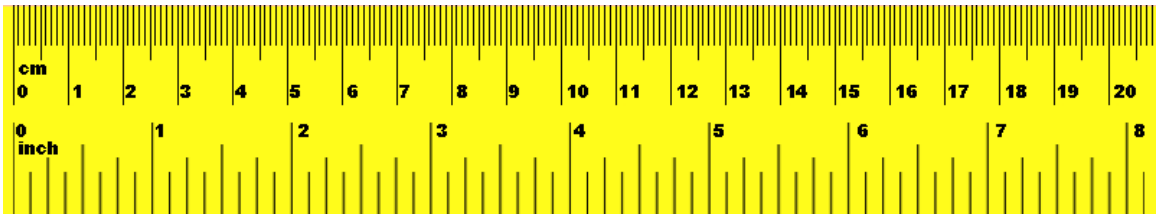
1a. Your school has decided to plant tulips in the school garden. There are a total of 3 rows and 5 columns of seeds. Each space gets one flower. Using the plot provided, draw the tulip patch in the garden.

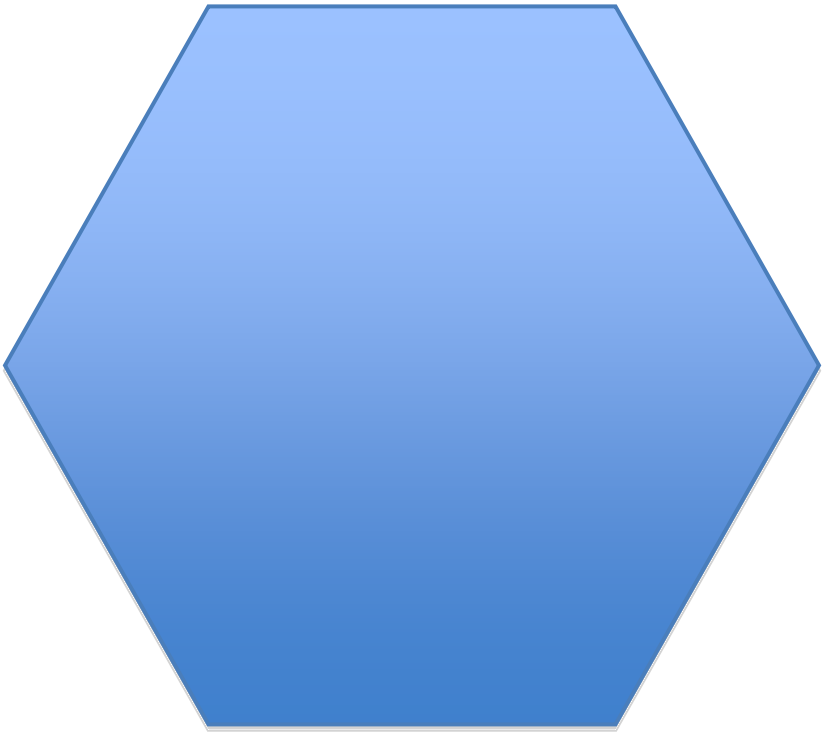
How many tulips will grow? _____

1b. Your principal wants your class to plant the same amount of tulips from the class garden in the school garden shown below. The principal wants to fill the extra space of the garden with daisies. Draw the garden using **T** for tulips and **D** for daisies. Show and explain your mathematical thinking.

How many **more** daises will there be than tulips? _____

2. **Measure** and label the side length in inches of the hexagon below. **Label** each side length. Use your mathematical thinking to show the **sum of all equal sides.**





Rubric for *Tulips & Daisies*

	4 points	**3 points**	**2 points**	**1 point**
2.OA.1 Use addition and subtraction within 100 to solve one- and two-step word problems involving situations of adding to, taking from, putting together, taking part, and comparing, with unknown in all positions, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.	N/A	In problem #1b, the student correctly answers the question "how many more?" (5 more). Drawings or equations with symbols are accurately represented when showing work.	The student used subtraction but didn't arrive at correct answer.	The student did not use the subtraction operation to solve for the problem.
2.OA.4 Use addition to find the total number of objects arranged in rectangular arrays with up to 5 rows and up to 5 columns; write an equation to express the total as a sum of equal addends.	N/A	The student writes an equation to express the total sum of two rectangular arrays.	The student does not show addition or does not create correct arrays.	The student did not use the addition operation to solve for the problem.
2.G.2 Partition a rectangle into rows and columns of same- size squares and count to find the total number of them.	N/A	In problem #1a, the student correctly tiles the figure (5x3) with an answer of 15 tulips. The student is expected to draw a grid with appropriate number of rows and columns.	The student draws a grid of rows and columns and counts units to find the total sum; however, the number of rows and columns or the final answer is incorrect.	• The student does not demonstrate an understanding of rows and columns by drawing a grid. • The student does not count squares to find the area.
2.MD.1 Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tape.	N/A	In problem #2 the student correctly chooses the inches side to measure the side length and arrives at the correct answer of 3 inches for the side length.	The student measures in centimeters instead of inches.	The student does not use the ruler to measure the side length.
2.MD.5 Use addition and subtraction within 100 to solve word problems involving lengths that are given in the same units, e.g. by using drawings (such as drawings of rulers) and equations with a symbol for the unknown to represent the problem.	N/A	In problem #2 the student correctly finds the sum of 18 inches.	The student used the correct operation, but did not arrive at the right answer.	The student did not use the correct operation to solve the problem.
MP.1 Make sense of problems and persevere in solving them.	An efficient strategy is chosen and progress towards a solution is evaluated. Adjustments in strategy, if necessary, are made along the way, and/or alternative strategies are considered.	A correct strategy is chosen based on mathematical situation in the task. Planning or monitoring of strategy is evident. Evidence of solidifying	A partially correct strategy is chosen, or a correct strategy for only solving part of the task is chosen. Evidence of drawing on some previous knowledge is present, showing some relevant engagement in the	No strategy is chosen, or a strategy is chosen that will not lead to a solution. Little or no evidence of engagement in the task is present.

	Evidence of analyzing the situation in mathematical terms, and extending prior knowledge is present. *Source: Exemplars*	prior knowledge and applying it to the problem solving situation is present. *Source: Exemplars*	task. *Source: Exemplars*	*Source: Exemplars*
MP.4 Model with mathematics	Abstract or symbolic mathematical representations are constructed to analyze relationships, extend thinking, and clarify or interpret phenomenon. *Source: Exemplars*	Appropriate and accurate mathematical representations are constructed and refined to solve problems or portray solutions. *Source: Exemplars*	An attempt is made to construct mathematical representations to record and communicate problem solving. *Source: Exemplars*	No attempt is made to construct mathematical representations. *Source: Exemplars*

Total Points	☐ **Level 4**	☐ **Level 3**	☐ **Level 2**	☐ **Level 1**
_____	21-23 points	18-20 points	15-17 points	14 points and below

Student Name _____ **Date** _____

Task Description: The performance task entitled *Tulips & Daisies* is designed to measure students' prior knowledge and skill in partitioning a rectangle into rows and columns of same-size squares, and counting to find the total number of squares (2.G.2). Students are asked to solve for the unknown in a word problem using addition and subtraction within 100 (2.OA.1) when given a rectangular array up to 5 rows and up to 5 columns (2.OA.4). Students are also asked to demonstrate their proficiency in measuring lengths of a polygon with a drawing of a ruler (2.MD.1) and to find the perimeter of a polygon in a word problem (2.MD.5). This task should be administered at the start of the unit.

Circumstances of Performance

☐ In Small Group ☐ 1:1 Assistance ☐ Independent

Levels of Support

☐ _____% Adult Support _____% Peer Support Other: _____

☐ Full Physical (hand over hand) ☐ Partial Physical ☐ Gestural ☐ Visual ☐ Verbal

Comments

Next Steps (specific to Common Core)

COMMON CORE-ALIGNED TASK
WITH INSTRUCTIONAL SUPPORTS

Mathematics

Grade 3 Math: City Farmers

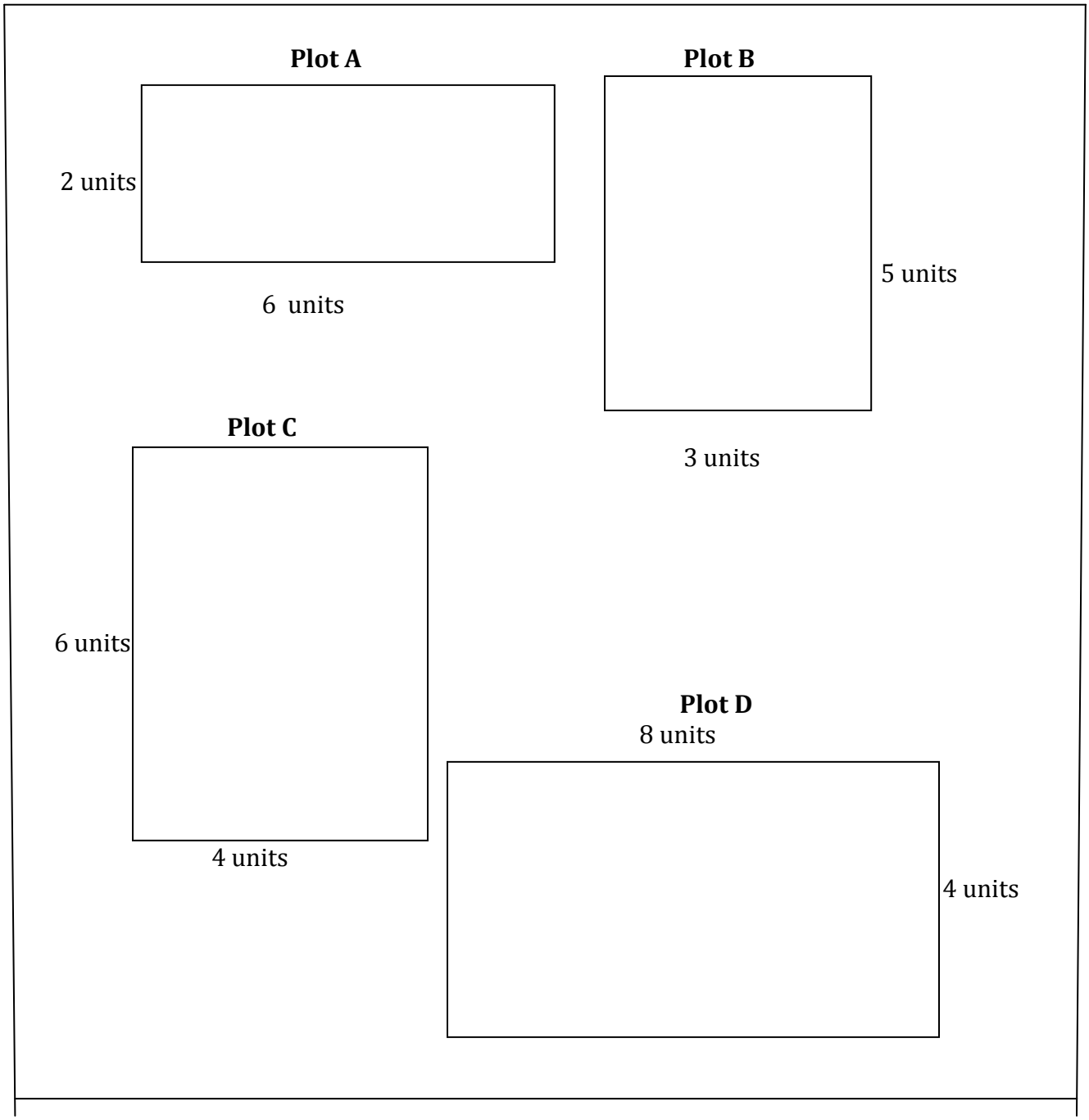
FORMATIVE ASSESSMENT

Ms. Smith's Planting Predicament

In week two, teachers would use the formative assessment entitled *Ms. Smith's Class Planting Predicament*. Students are asked to find the area of four plots by multiplying side lengths (3.MD.7b) and finding the total area of the garden by adding the areas of non-overlapping parts (3.MD.7d). Students are then asked to tile the garden map without gaps (3.MD.5b) to find the area of the entire space (3.MD.7a). Most students will complete the task in 15-20 minutes, although time should not be a factor.

Ms. Smith's Class
Planting Predicament

The students in Ms. Smith's class want to plant their tomato seedlings in the school's garden. The school's garden is made up of four empty plots and pathways in between and around each plot.



Formative Assessment
Task #1

Complete the chart.

Garden Plot	Area
A	
B	
C	
D	

1. The class needs an area of **at least** 24 square units to plant all of their tomato seedlings. Each class is allowed to select one plot.

   Which plot(s) would Ms. Smith's class serve the needs of the class ?

   _____

   Which plot(s) would they not serve the needs of their class?

   _____

   Explain why the class would or would not be able to use each plot.

2. What is the **total** area of **planting space** (not including the pathways) in the school garden? Show and explain your mathematical thinking.

_____

_____

_____

_____

Formative Assessment
Task #1

3. The school garden committee wants to know the area of the **entire** school garden in square yards (including pathways). Use the tiles provided to find the area in square yards. Explain two ways that you can find your answer in your mathematical thinking.

_____

_____

_____

_____

= 1 square yard

Rubric for *Ms. Smith's Class Planting Predicament*

	4 points	**3 points**	**2 points**	**1 point**
3.MD.7b Multiply side lengths to find areas of rectangles with whole-number side lengths in the context of real world and mathematical problems, and represent whole-number products as rectangular areas in mathematical reasoning.	N/A	In problem #1, the student shows that he/she can correctly multiply the side lengths of each plot to find the area for each plot. The student shows which garden plots the students could use because the area is 24 or higher and which plots the students could not use because the area is less than 24.	In problem #1, the student used the side lengths of the 4 garden plots to multiply but did not arrive at the correct area or did not show which garden plots would or would not work for Ms. Smith's class.	In problem #1, the student did not find the area of the garden plots and did not show which garden plots would or would not work for Ms. Smith's class.
3.MD.7d 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.	N/A	In problem #2, the student shows that he/she recognizes area as additive by demonstrating that if all four garden plot areas are added, the total area of planting space can be found. The student arrives at the correct total area by adding all four garden plot areas.	In problem #2, the student shows that he/she recognizes area as additive but does not arrive at the correct total area of all four garden plot areas.	In problem #2, the student does not show that he/she recognizes area as additive and does not arrive at the correct total area of all four garden plots.
3.MD.5b 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.	N/A	In problem #3, the student places tiles without overlapping to cover the entire area of the school garden and correctly counts the tiles to find the total area.	In problem #3, the student places tiles without overlapping but does not correctly count the tiles to find the total area.	In problem #3, the student places tiles with overlapping and does not correctly count the tiles to find the total area.
3.MD.7a 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.	N/A	In problem #3, the student uses equations, drawings, and/or words to explain how counting all of the square tiles as well as multiplying the side lengths of unit squares can result in the area.	In problem #3, the student explains how the area can be found using two methods, but the student solved the answer incorrectly.	In problem #3, the student uses only multiplication or only tile counting to arrive at an answer.
MP.1 Make sense of problems and persevere in solving them.	An efficient strategy is chosen and progress towards a solution is evaluated. Adjustments in strategy, if necessary, are made along the way, and/or alternative strategies are considered.	A correct strategy is chosen based on mathematical situation in the task. Planning or monitoring of strategy is evident. Evidence of solidifying prior knowledge and applying it to the problem	A partially correct strategy is chosen, or a correct strategy for only solving part of the task is chosen. Evidence of drawing on some previous knowledge is present, showing some relevant engagement in the task.	No strategy is chosen, or a strategy is chosen that will not lead to a solution. Little or no evidence of engagement in the task present

	Evidence of analyzing the situation in mathematical terms, and extending prior knowledge is present. *Source: Exemplars*	solving situation is present. *Source: Exemplars*	*Source: Exemplars*	*Source: Exemplars*
MP.3 Construct viable arguments and critique the reasoning of others.	Deductive arguments are used to justify decisions and may result in formal proofs. Evidence is used to justify and support decisions made and conclusions reached. This may lead to... ▪ testing and accepting or rejecting of a hypothesis or conjecture. ▪ explanation of phenomenon. ▪ generalizing and extending the solution to other cases. *Source: Exemplars*	Arguments are constructed with adequate mathematical basis. A systematic approach and/or justification of correct reasoning is present. This may lead to... ▪ clarification of the task. ▪ exploration of mathematical phenomenon. ▪ noting patterns, structures, and regularities. *Source: Exemplars*	Arguments are made with some mathematical basis. Some correct reasoning or justification for reasoning is present with trial and error, or unsystematic trying of several cases. *Source: Exemplars*	Arguments are made with no mathematical basis. No correct reasoning nor justification for reasoning is present. *Source: Exemplars*
MP.4 Model with mathematics.	Abstract or symbolic mathematical representations are constructed to analyze relationships, extend thinking, and clarify or interpret phenomenon. *Source: Exemplars*	Appropriate and accurate mathematical representations are constructed and refined to solve problems or portray solutions. *Source: Exemplars*	An attempt is made to construct mathematical representations to record and communicate problem solving. *Source: Exemplars*	No attempt is made to construct mathematical representations. *Source: Exemplars*

Total Points	☐ **Level 4**	☐ **Level 3**	☐ **Level 2**	☐ **Level 1**
_____	22-24 points	20-23 points	17-19 points	16 points and below

Student Name _____ **Date** _____

Task Description: This formative assessment entitled *Ms. Smith's Class Planting Predicament* asks students to find the area of four plots by multiplying side lengths (3.MD.7b) and finding the total area of the garden by adding the areas of non-overlapping parts (3.MD.7d). Students are then asked to tile the garden map without gaps (3.MD.5b) to find the area of the entire space (3.MD.7a).

Circumstances of Performance

☐ In Small Group ☐ 1:1 Assistance ☐ Independent

Levels of Support

☐ _____% Adult Support _____% Peer Support Other: _____

☐ Full Physical (hand over hand) ☐ Partial Physical ☐ Gestural ☐ Visual ☐ Verbal

Comments

Next Steps (specific to Common Core)

COMMON CORE-ALIGNED TASK
WITH INSTRUCTIONAL SUPPORTS

Mathematics

Grade 3 Math: City Farmers

FORMATIVE ASSESSMENT

Winter Vegetables

In week three, teachers would use the formative assessment entitled Winter Vegetables. When given the side lengths of two connecting vegetable patches, students are asked to sketch and label a garden map using tiling to show distributive property, and they also must explain their mathematical reasoning of how they found and confirmed the larger area (3.MD.7c, 3.MD.7b). Most students will complete the task in 15-20 minutes, although time should not be a factor.

Winter Vegetables

1. During the winter months, the school wants to continue to use the garden by planting winter vegetables. The gardener would like to plant 6 rows of vegetables in a sequence of 5 heads of cabbage followed by 4 potatoes in each row. Showing your work, explain how many total vegetables will grow this winter.

Draw the garden in the space provided. Label each vegetable patch.

Winter Garden

2. If you have a collard greens plot that has side lengths of 5 feet and 8 feet, how many seeds can you plant in the garden plot? Why?

Collard Greens Seed Packet
Requires 2 square feet per seed

_____

_____

_____

_____

Rubric for *Winter Vegetables*

	4 points	**3 points**	**2 points**	**1 point**
3.MD.7 Relate area to the operations of multiplication and addition. **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 x b and a x c. Use area models to represent the distributive property in mathematical reasoning.	N/A	• Student will arrive at the correct answer, including appropriate labeling of dimensions. • Student will use appropriate mathematical equations to arrive at the answer. • The garden outline will be properly filled in.	• Student either arrives at the correct answer but does not show work, or shows his/her work but does not arrive at the correct answer. • Student attempts to use appropriate mathematical equations, but does so incorrectly. • The garden outline was attempted to be filled in, but does not reflect appropriate number models.	• Student does not arrive at the correct answer and either does not label the garden, or labels it incorrectly. • Student does not show work or does not attempt to use appropriate mathematical equations. • The garden outline is not filled in at all.
3.MD.7 Relate area to the operations of multiplication and addition. **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.	N/A	• (1) The student correctly finds area of the figure by multiplying side lengths (6x9=54). • (2) The student correctly finds the area of the garden plot by multiplying the side lengths (5x8=40 sq units).	• (1 & 2) The student shows understanding of how to find area, but incorrectly solves the multiplication problem.	• (1 & 2) The student does not use the lengths of the rectangle to find the area.
MP.1 Make sense of problems and persevere in solving them.	An efficient strategy is chosen and progress towards a solution is evaluated. Adjustments in strategy, if necessary, are made along the way, and/or alternative strategies are considered. Evidence of analyzing the situation in mathematical terms, and extending prior knowledge is present. *Source: Exemplars*	A correct strategy is chosen based on mathematical situation in the task. Planning or monitoring of strategy is evident. Evidence of solidifying prior knowledge and applying it to the problem solving situation is present. *Source: Exemplars*	A partially correct strategy is chosen, or a correct strategy for only solving part of the task is chosen. Evidence of drawing on some previous knowledge is present, showing some relevant engagement in the task. *Source: Exemplars*	No strategy is chosen, or a strategy is chosen that will not lead to a solution. Little or no evidence of engagement in the task present. *Source: Exemplars*
MP.4 Model with mathematics.	Abstract or symbolic mathematical representations are constructed to analyze	Appropriate and accurate mathematical representations are constructed and refined to	An attempt is made to construct mathematical representations to record and communicate problem	No attempt is made to construct mathematical representations.

	relationships, extend thinking, and clarify or interpret phenomenon. *Source: Exemplars*	solve problems or portray solutions. *Source: Exemplars*	solving. *Source: Exemplars*	*Source: Exemplars*

Total Points	☐ **Level 4**	☐ **Level 3**	☐ **Level 2**	☐ **Level 1**
_____	13-14 points	11-12 points	9-10 points	8 points and below

Formative Assessment
Task #2

Student Name _____ **Date** _____

Task Description: This is feedback from the formative assessment entitled *Winter Vegetables*. When given the side lengths of two connecting vegetable patches, students are asked to sketch and label a garden map using tiling to show distributive property, and they also must explain their mathematical reasoning of how they found and confirmed the larger area (3.MD.7c, 3.MD.7b).

Circumstances of Performance

☐ In Small Group ☐ 1:1 Assistance ☐ Independent

Levels of Support

☐ _____% Adult Support _____% Peer Support Other: _____

☐ Full Physical (hand over hand) ☐ Partial Physical ☐ Gestural ☐ Visual ☐ Verbal

Comments

Next Steps (specific to Common Core)

COMMON CORE-ALIGNED TASK
WITH INSTRUCTIONAL SUPPORTS

Mathematics

Grade 3 Math: City Farmers

FORMATIVE ASSESSMENT

Fencing the Gardens

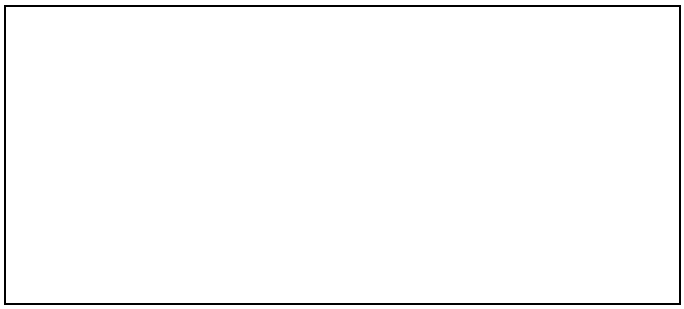
In week four, teachers would use the formative assessment entitled Fencing the Gardens. Students are asked to first use addition to count the total number of unit squares and verify answers through multiplication (3.MD.6, 3.MD.7a). Next, they are asked to solve a real world problem involving rectangular gardens with the same perimeter and different areas; students must determine an unknown side length to solve for area for the entire garden (3.MD.8). Most students will complete the task in 15-20 minutes, although time should not be a factor.

Fencing the Gardens

1. As classes line up for recess, flowers are getting accidentally trampled on, so your school has decided to fence two gardens.

a. The total perimeter of Garden A is 30 feet. Draw and label one way to use the garden space in the layout below. Using addition and multiplication, show and explain how to find the area.

Garden A



_____

_____

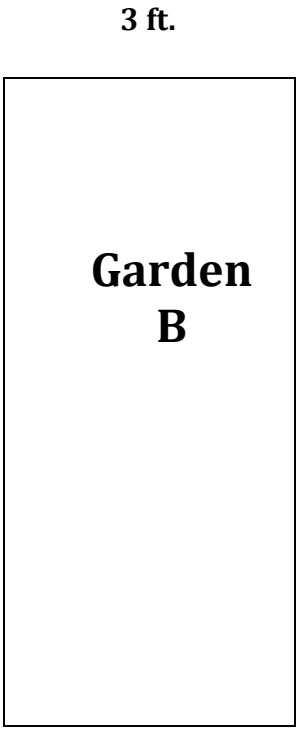
_____

_____

b. If both school gardens have the same perimeter, what is the unknown side length of Garden B? _____

What is the area? _____

Show all mathematical thinking.



Rubric for *Fencing the Gardens*

	4 points	**3 points**	**2 points**	**1 point**
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.	N/A	The student correctly shows that 1 square equates to 1 unit by matching number of tiles to side lengths.		The student does not show that one square is the same as one unit of area.
3.MD.6 Measure areas by counting unit squares (square cm, square m, square in, square ft, and improvised units).	N/A	In problem #1, the student correctly tiles the figure to show an area of 54, 50, or 36.	The student uses addition to find the area by counting unit squares; however, the total sum does not match the grid.	The student does not draw columns and rows to demonstrate that he or she found the area by counting the unit squares.
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.	N/A	In problem #1, the student partitions the garden appropriately (6x9, 5x10, or 12x3). The equation matches side lengths to show that work is checked and verified.	The student's response does not match the addition answer and multiplication answer.	The student only uses addition or multiplication to solve the word problem.
3.MD.8 Solve real world and mathematical problems involving perimeters of polygons, including finding the perimeter given the side lengths, finding an unknown side length, and exhibiting rectangles with the same perimeter and different areas or with the same area and different perimeters.	N/A	In problem #2, the student correctly solves for a side length of 12, and finds area of 36 by either counting unit squares or multiplying side lengths.	The student finds the unknown side length but does not find the area.	The student does not use the same perimeter of problem #1 to find the unknown side length.
MP.1 Make sense of problems and persevere in solving them.	An efficient strategy is chosen and progress towards a solution is evaluated. Adjustments in strategy, if necessary, are made along the way, and/or alternative strategies are considered. Evidence of analyzing the situation in mathematical terms, and extending prior	A correct strategy is chosen based on the mathematical situation in the task. Planning or monitoring of strategy is evident. Evidence of solidifying prior knowledge and applying it to the problem solving situation is present.	A partially correct strategy is chosen, or a correct strategy for only solving part of the task is chosen. Evidence of drawing on some previous knowledge is present, showing some relevant engagement in the task. *Source: Exemplars*	No strategy is chosen, or a strategy is chosen that will not lead to a solution. Little or no evidence of engagement in the task present. *Source: Exemplars*

	knowledge is present. *Source: Exemplars*	*Source: Exemplars*	*Source: Exemplars*	
MP.4 Model with mathematics.	Abstract or symbolic mathematical representations are constructed to analyze relationships, extend thinking, and clarify or interpret phenomenon. *Source: Exemplars*	Appropriate and accurate mathematical representations are constructed and refined to solve problems or portray solutions. *Source: Exemplars*	An attempt is made to construct mathematical representations to record and communicate problem solving. *Source: Exemplars*	No attempt is made to construct mathematical representations. *Source: Exemplars*

Total Points	☐ **Level 4**	☐ **Level 3**	☐ **Level 2**	☐ **Level 1**
_____	18-20 points	14-16 points	13-15 points	12 points and below

Student Name _____ **Date** _____

Task Description: The formative assessment entitled *Fencing the Gardens* asks students to first use addition to count the total number of unit squares and to verify the answer through multiplication (3.MD.6, 3.MD.7a). Next, they are asked to solve a real world problem involving rectangular gardens with the same perimeter and different areas; students must determine an unknown side length to solve for area for the entire garden (3.MD.8).

Circumstances of Performance

☐ In Small Group ☐ 1:1 Assistance ☐ Independent

Levels of Support

☐ _____% Adult Support _____% Peer Support Other: _____

☐ Full Physical (hand over hand) ☐ Partial Physical ☐ Gestural ☐ Visual ☐ Verbal

Comments

Next Steps (specific to Common Core)

COMMON CORE-ALIGNED TASK
WITH INSTRUCTIONAL SUPPORTS

Mathematics

Grade 3 Math: City Farmers

INSTRUCTIONAL SUPPORT FOR STUDENTS

The instructional supports on the following pages include entry points for diverse learners using Gardner's Multiple Intelligences Theory. For this unit, we have prioritized the three most common challenges that students might face when studying area and perimeter.

Linguistic Access

In these supportive materials, a distinction between the vocabulary and the language functions is needed to provide entry points to the math content. Both need to be clarified to ensure comprehension and to avoid misunderstanding. Introducing and/or reviewing the most essential vocabulary and language functions in context and with concrete models, when applicable, in order for students to better understand the meaning of the terms, can do this. The following vocabulary/language functions are suggested:

Language Functions: decide, analyze, explain, describe, display, critique, strategy, assess

Vocabulary Words/Concepts

Tier I (basic words that can often be explained through use of picture support)

- rectangle
- row
- column
- cm., in., ft., yd.
- unit square
- same, different
- grid
- length, width
- array
- garden, gardener
- plant bed
- vegetable patch
- plot
- garden pathway
- planting space

*For students who have difficulty processing language, we recommend **providing picture support** as immediate visual cues for Tier I words.

Tier II (high frequency words loaded with meaning)

- partition
- measure
- tiling
- counting
- adding
- multiplying
- decompose
- compose
- overlap

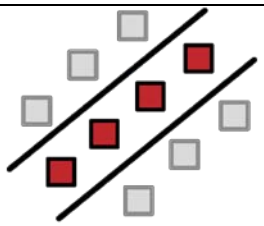
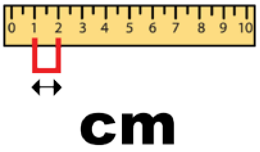
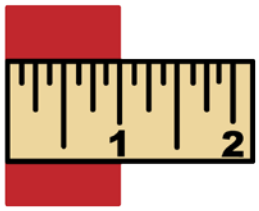
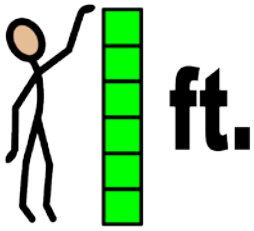
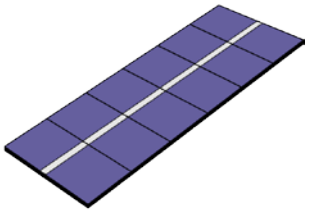
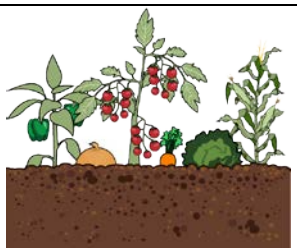
*We recommend providing more direct instruction for this list of words. In addition, **consider taking pictures of students modeling Tier II words**; these pictures can be posted on the bulletin board or inside the reference section of a student math journal. In their notebooks, students should write a short explanation of their actions in the picture.

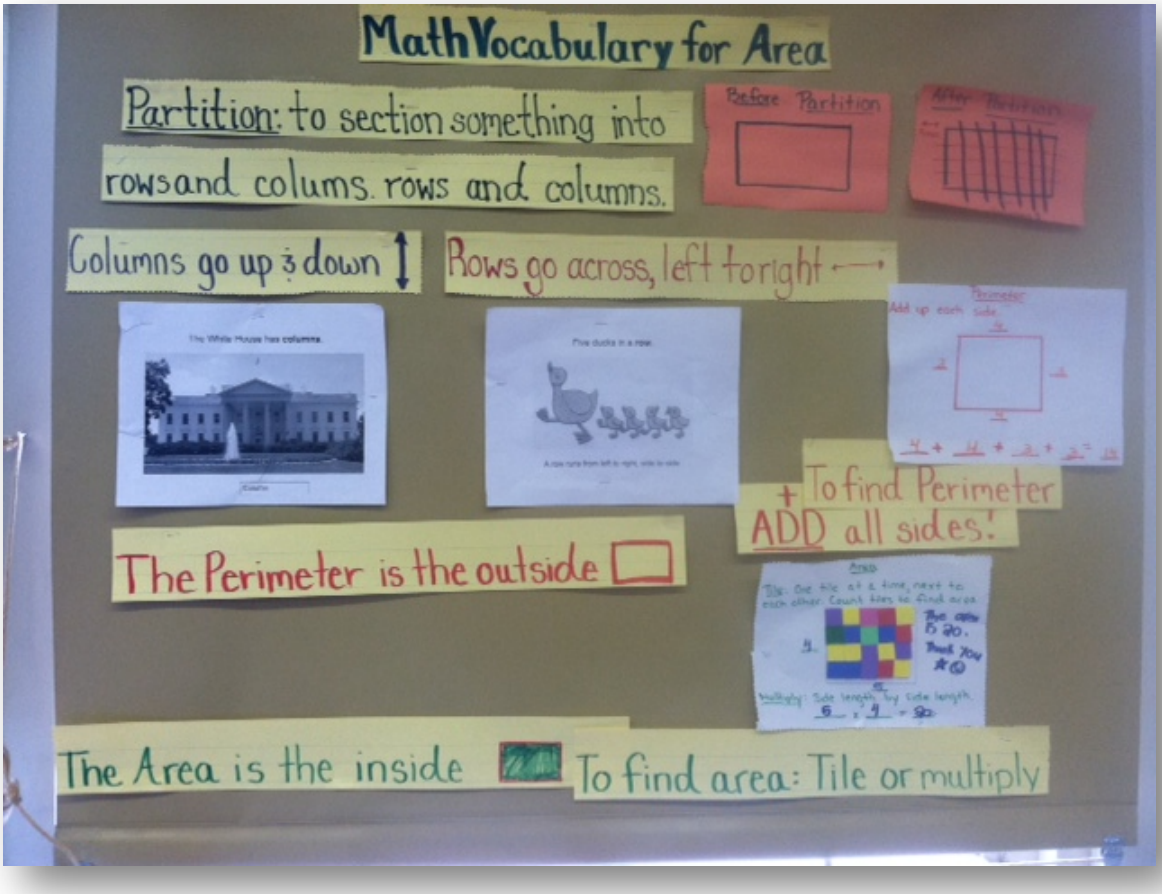
Tier III (**technical language and domain-specific concepts**):

- area
- perimeter
- additive property
- distributive property

*For technical words and domain-specific concepts, we recommend **having students create a Math Concept Dictionary** in which they: (1) draw a picture or diagram, (2) provide a mathematical example of a problem and solution, (3) explain the strategy used to solve the problem, and (4) describe a time when this concept would be used in the real world. Also, consider pairing students with a partner to check the dictionary for accuracy, reasonableness, and efficiency.

Tier I words (example)

 row		 inch	
rectangle	 array	 garden	gardener



Real World Visual Examples of Tier I Words

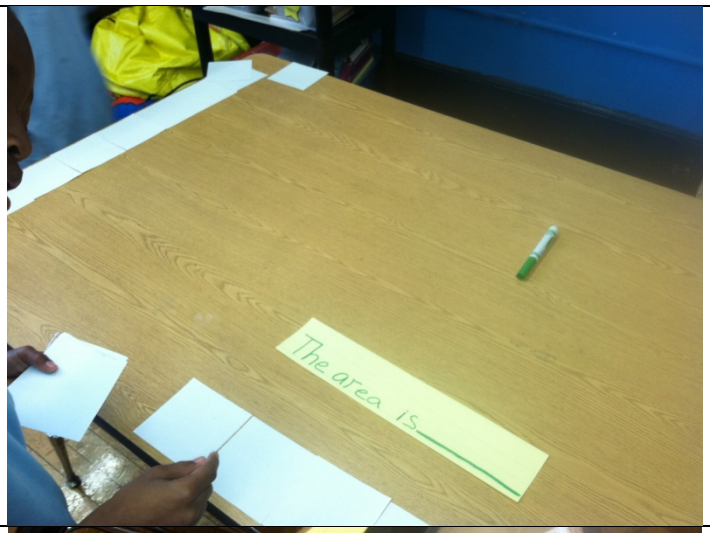
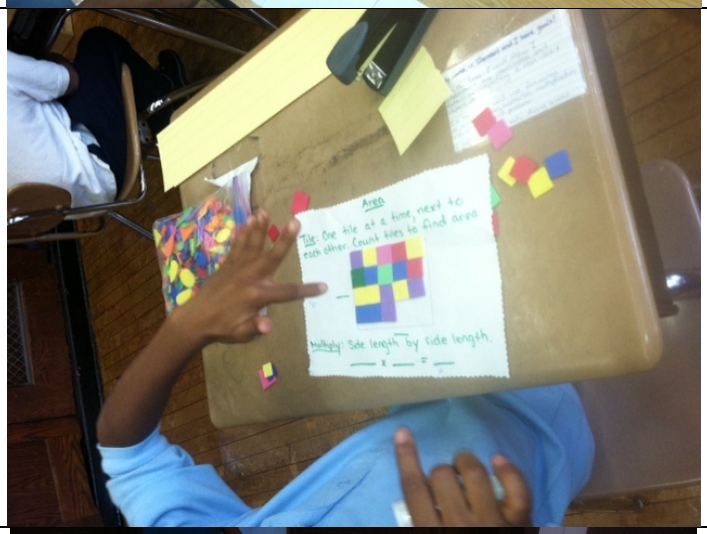
Ducks in a **row.**

A row runs left to right, side to side.

The White House has **columns.**

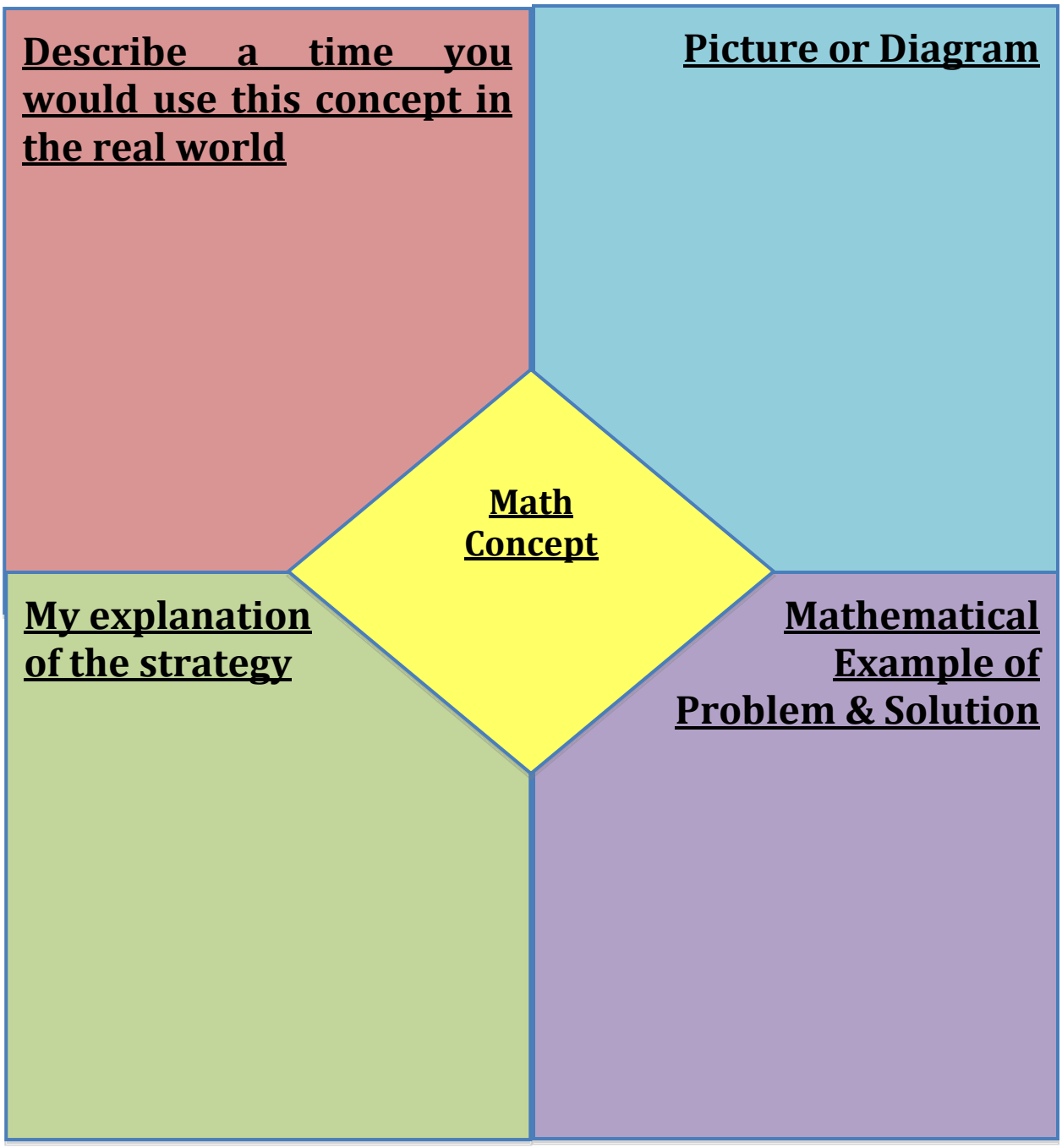
Column

Tier II words (example)

Tiling board without **overlap**			
Counting tiles to find area			
Composing smaller areas into a larger area			

Tier III words & concepts (example)

Name _____ Date_____



Partner's Response Sheet **Partner's Name** _____

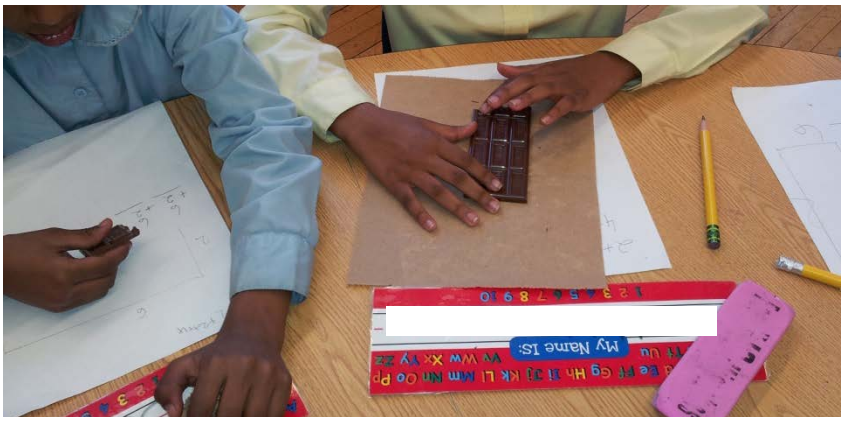
☐ Here's another strategy or approach ☐ I would like to add more description to your explanation

Visual-Spatial Access

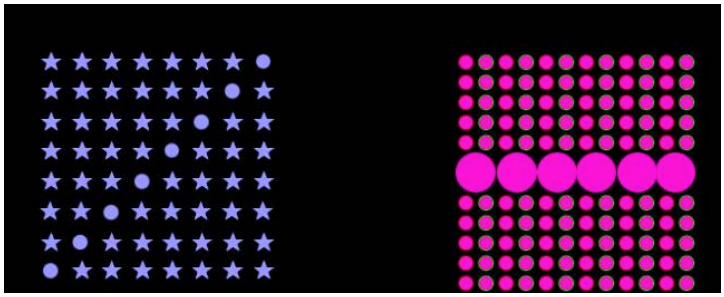
These supportive materials show how to present information in multiple ways to engage students. **Visual perception** is a function of our eyes and brain. For students who see figures as a whole rather than in parts, we have provided an assortment of resources to help them decompose rectilinear arrays.

To help students break down images, we recommend modifying…

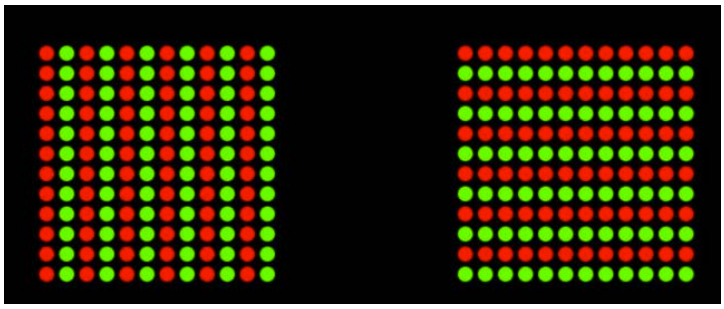
- ☐ **Texture**: Help students break apart the area by providing sensory modifications. Provide some counting blocks with a smooth or fuzzy surface (for example, glue cotton balls to the surface of a block) and others with a rough, grainy surface (for example, glue sandpaper or rice to the top face of a block). Also, consider using Hershey's chocolate bars for students to feel the ridges in each square unit of the rectilinear array.



- ☐ **Shapes**: Have students recognize a particular part of the area with a different shape or size of the shape.

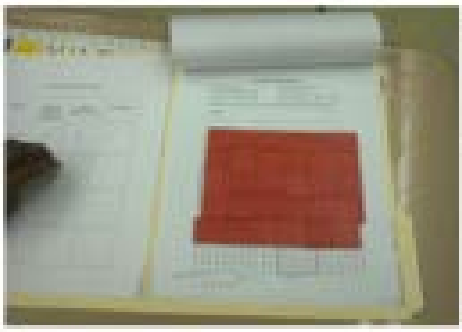


☐ **Color**: Have students recognize the difference between a row and column by differentiating color spectrum display.



☐ **Color**: Have students use different color blocks in an area problem to distinguish the smaller areas within a larger area.

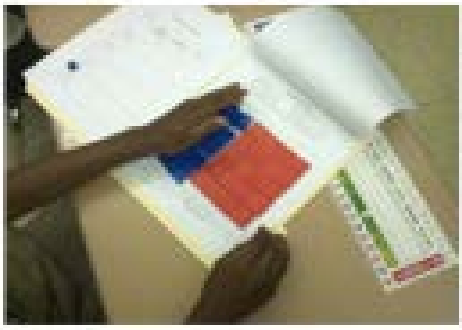
For students who require more visual-spatial supports, Garden Activity #3 *(see pgs.63-64)* can be used to support student's understanding of the distributive property as shown below.



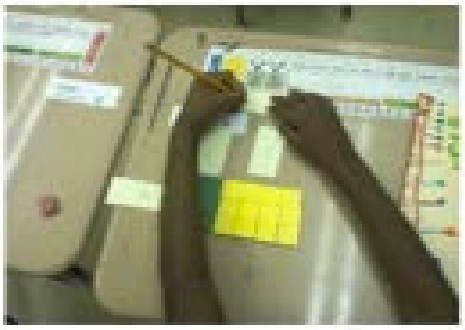
Garden Activity 3 - 1

Garden Activity 3 - 2

Garden Activity 3 - 3



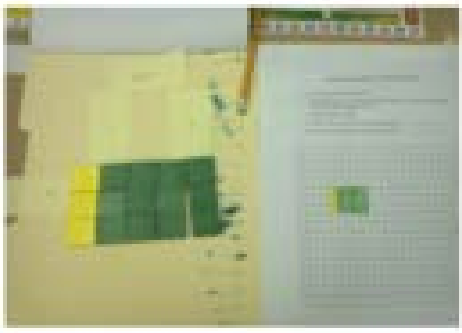
Garden Activity 3 - 4



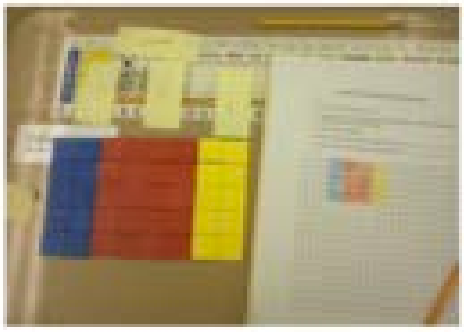
Garden Activity 3 - 5

Garden Activity 3 - 6

Garden Activity 3 - 7

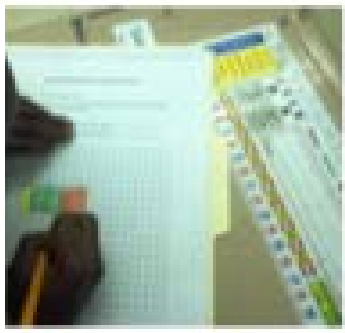


Garden Activity 3 - 8

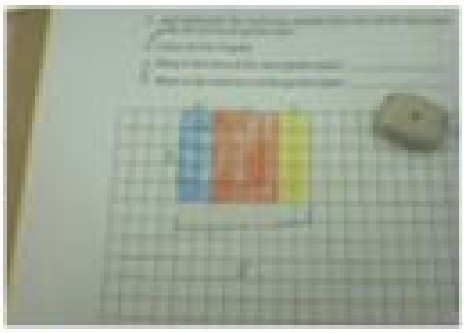


Garden Activity 3 - 9

Garden Activity 3 - 10



Garden Activity 3 - 11



Garden Activity 3 - 12

Intrapersonal/ Interpersonal Access

For students who require more opportunities to interact with others and/or self-reflect on their work, these supports help them engage in critical thinking throughout the unit.

☐ **Small Group**: Have students play games and participate in math think-tank groups. When students are working cooperatively in a group, each student should independently solve the problem according to his/her primary role.

Here is a list of various multi-sensory roles:

- Architects: For the *tactile* learner, the student models the problem and solution through construction and/or display of concrete objects.
- Visual Producer: For the *visual* learner, the student explains his/her mathematical thinking through drawings, illustrations, and/or data charts.

- Author: For the *linguistic* learner, the student coordinates the written work; he/she communicates mathematical thinking through words.

- Journalist: For the *auditory* learner, the student orally reports the answer and connects ideas to related concepts in math and real-world contexts.

*For students who may need additional support and may not be ready for solving the answer independently, we recommend using the Jigsaw method. First, have the Visual Producers work together in a small group and the Journalists work together in a small group, etc. All small group members can support each other in problem solving. Then have each member report back their answer and thinking to the jigsaw group containing leaders from Architecture, Visual Production, Authorship, and Journalism.

☐ **Partner Talk**: Have students interact one-on-one with each other using the following inquiries and statements to guide their discussion

Encourage these Types of Questions

- Why do you think that?
- Why does that make sense?
- How can you prove that?

- Does that strategy always work? Is it true for all cases?
- Can you provide a different way to think about the problem?
- Can you make a model and show me?
- How does this relate to…?

<u>Encourage these Response Stems</u>

- So let me repeat what you just said in my own words
- Let's try…
- You gave me an idea. It is…
- I'm wondering if…
- Hey! There's another solution.
- What would happen if…
- My response is similar in this way ___, but it is different in this way___

☐ **Self Reflection Logs**: Have students keep a "Numbers & Logic Diary" to record their mathematical thinking. Here are sample journal prompts:

- Write a letter to an absent student explaining to him/her what they missed.
- Write additional math problems similar to today's work.
- Describe everyday uses (other than gardening) for what we learned.
- Offer tips to give to a friend for solving today's math problem,
- What are the effects of overlapping tiles when solving for area?
- Design a math slogan for what I learned today.
- What would I ask my teacher to explain about today's math? And why?
- What would be a great activity or game to play with friends involving area? How do you win the game?
- Write a math riddle for shapes with same areas and different perimeters and vice versa.
- Create your own realistic fiction story for area.

COMMON CORE-ALIGNED TASK
WITH INSTRUCTIONAL SUPPORTS

Mathematics

Grade 3 Math: City Farmers

ADDITIONAL SUPPORTS

The resources on the following pages include extension activities that can be used for homework, intervention support, small group work, and/or finish-early exercises.

Name _____ Date_____

Perimeter and Columns/Rows

Math Practice

Directions: Students practiced partitioning rectangles into rows and columns today to find the area. For homework, students are to practice the same skill.

Remember:

- **Partition** means to break up or section into rows and columns.
- A **row** goes side to side.
- A **column** goes up and down.
- **Perimeter** is determined by adding both lengths and widths.
- **Perimeter** is the total distance around the outside of a rectangle.
- **Distance** how far something is.

1. Ms. Kleinschmidt decides she needs more tulips. She asks the janitor to change her garden plan to 2 rows and 6 columns of tulips. Use the plot below to show how many tulips Ms. K wants the custodian to plant.

2. Ms. Parker decides that it would be really beautiful to plant roses in front of the school. She has enough space for 4 rows and 5 columns. Use the plot below to show how many roses she will be able to plant.

3. Use the side lengths to find the perimeter of this rectangle.

7 in.

4 in.

4. Use the side lengths to find the perimeter of this rectangle.

15 ft.

10 ft.

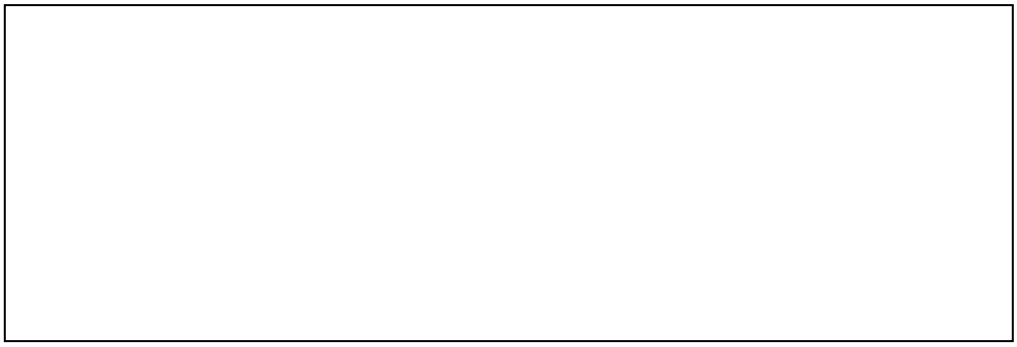
Name _____ Date_____

Finding Area with Multiplication

Math Practice

Ms. Keegan planted flowers in the following garden plots.

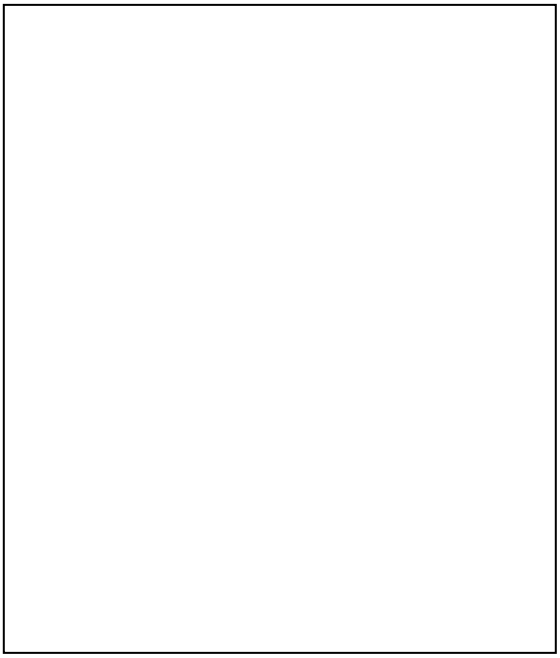
2 sq. units



7 sq. units

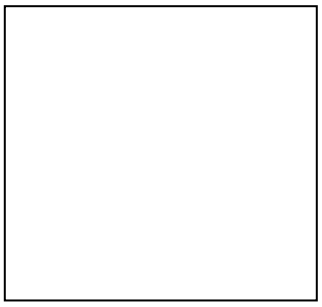
3 sq. units

6 sq.units



2 sq. units

2 sq. units



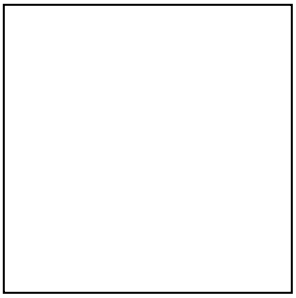
1. Show how you can find the area of each plot. Use pictures and words to represent your mathematical thinking.

2. Show how can you find the total area of all three garden plots. Use pictures and words to represent your mathematical thinking.

Name _____ Date_____

Vegetable Garden Review

1. Students from Class V72 want to plant carrots in the school garden. Ms. Tubito tells them they can plant 4 rows and 3 columns of carrots. Show how you could plant the carrots in the plot below and tell the number of carrots you were able to plant.



2. Ms. Quirke wants to fill the extra space in the garden plot with potatoes. How many more potatoes than carrots will there be in the garden? Show and explain your mathematical thinking.

_____

_____

_____

_____

Name _____ Date_____

Area Practice

1. Find the area of the rectangle below. Show your work.

Explain the strategy you used.

_____

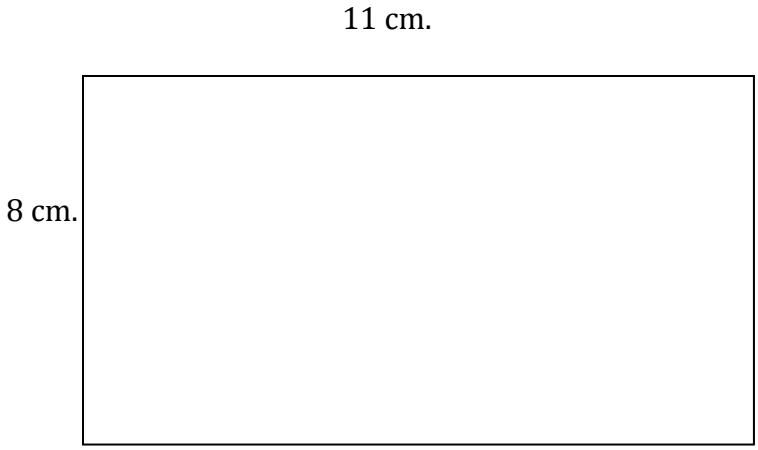
_____

_____

_____

_____

2. Find the area of the rectangle below. Show your work.



How is this strategy different than the previous strategy?

_____

_____

_____

_____

_____

Additional Text & Digital Support

Spaghetti and Meatballs for All by Marilyn Burns
Amanda Bean's Amazing Dream by Cindy Neuschwander
A Mathematical Story by Cindy Neuschwander
Bigger, Better, Best! (Mathstart 2) by Stuart J. Murphy
Boots & Gardening together with Children by Sharen Lovejoy
Growing Vegetable Soup by Lois Ehlert
Jack's Garden by Henry Cole
Peter Rabbit by Beatrix Potter
The Global Garden by Kate Petty & Jennie Maizels
The Ugly Vegetables by Grace Lin
Tops & Bottoms by Janet Stevens
Uno's Garden by Graeme Base

TEACHER INTERNET RESOURCES/ACTIVITIES:
www.onlinemathlearning.com/grade-3html
www.homeschoolmath.net/online/geometryphp#area
www.amathsdicitonaryforkids.com
http://store.aimsedu.org/aims_store/essential-math/perimeter-and-area-of-rectangles.html?gclid=CL6ugobeka8CFUXc4AodTSv0zA
http://mrsrenz.net/mathsites.htm#area-perim
http://www.scholastic.com – Math Mysteries

TEACHER RESOURCES:
Quick & Easy Math Art, **Area and Perimeter Pals** by Deborah Schecter, **Scholastic Teaching Resources**
Exploring Area, **Harcourt School Publishers**
Checklist for Problem Solving, **Scott Foresman Addison Wesley**

STUDENT RESOURCES:
http://www.bgfl.org/custom/resources_ftp/client_ftp/ks2/maths/perimeter_and_area/index.html

ONLINE PRACTICE:
http://www.shodor.org/interactivate/activities/PerimeterExplorer
http://www.mathsisfun.com/geometry/area.htmlhttp://www.shodor.org/interactivate/activities/AreaExplorer
http://www.onlinemathlearning.com/geometry-math-games.html
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