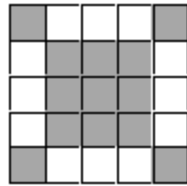


Using Structure and Repeated Reasoning to Explore Functions

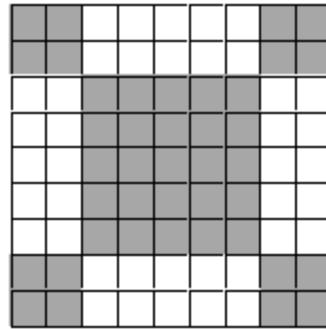
Edward C. Nolan

Sidewalk Patterns

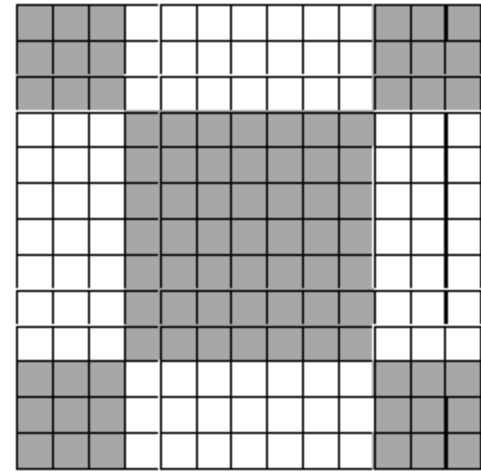
The blocks are in different shades to make patterns that are in various sizes.



Pattern #1

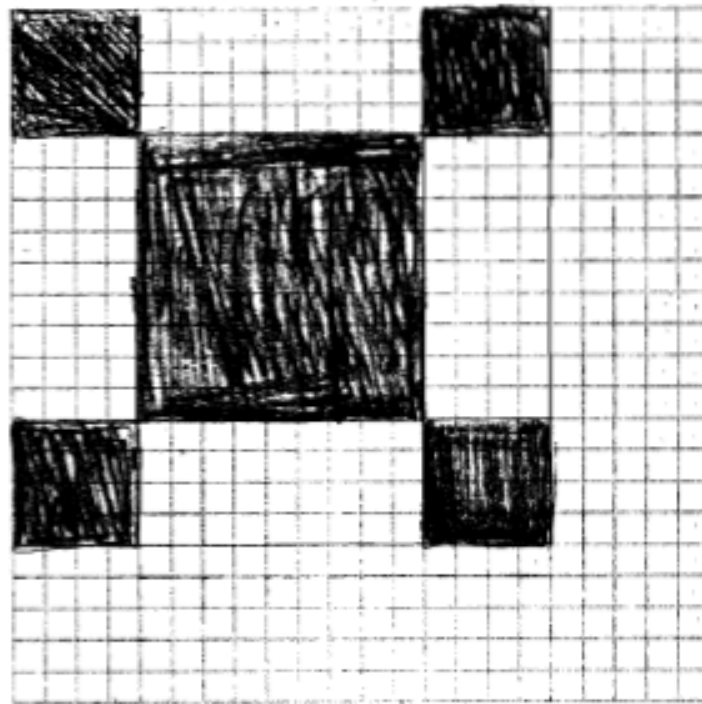


Pattern #2



Pattern #3

Sidewalk Patterns Student Work



Pattern #4

Sidewalk Patterns Student Work

1. Complete the table below

Pattern number, n	1	2	3	4
Number of white blocks	12	40	84	144
Number of gray blocks	13	41	85	145
Total number of blocks	25	81	169	289

2. What do you notice about the number of white blocks and the number of gray blocks?

There is always 1 more gray than a white block.

3. The total number of blocks can be found by squaring the number of blocks along one side of the pattern.

a. Fill in the blank spaces in this list.

$$25 = 5^2 \quad 81 = \underline{9^2} \quad 169 = \underline{13^2} \quad 289 = 17^2$$

b. How many blocks will pattern #5 need?

21

c. How many blocks will pattern # n need?

$4n+1$ blocks

$4n+1$
 $1 \quad 5$
 $2 \quad 9$
 $3 \quad 13$
 $4 \quad 17$
 $5 \quad 21$

Sidewalk Patterns Student Work

4. a. If you know the total number of blocks in a pattern you can work out the number of white blocks in it. Explain how you can do this.

$$\# \text{ of white blocks} = (\text{total \# of blocks} - 1) \div 2$$

- b. Pattern # 6 has a total of 625 blocks.

How many white blocks are needed for pattern #6?

Show how you figured this out.

312 white blocks

$$w = (\text{total} - 1) \div 2$$

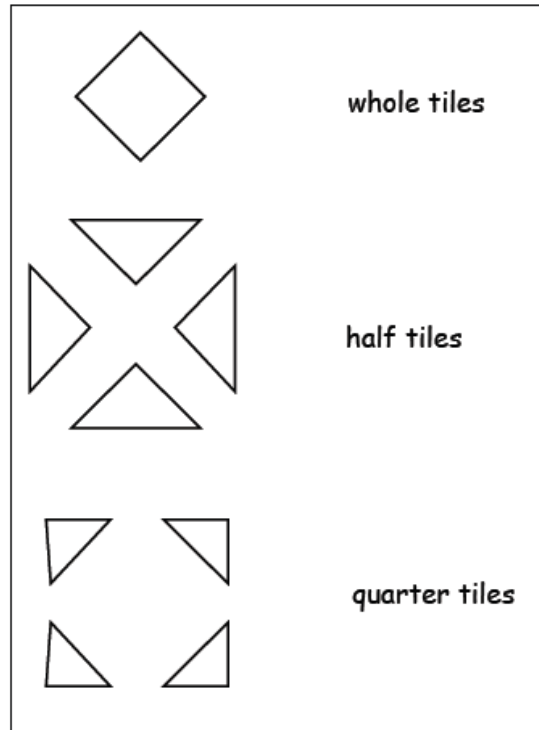
$$w = (625 - 1) \div 2$$

$$w = 624 \div 2$$

$$w = 312$$

Table Tiles

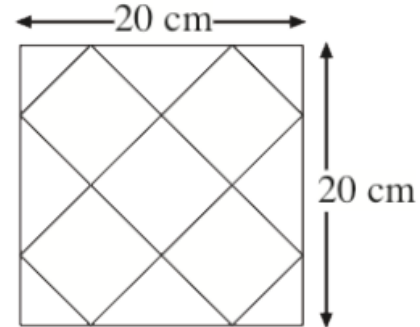
Maria uses three types of tiles:



The sizes of the square tabletops are all multiples of 10 cm.

Maria only uses quarter tiles in the corners and half tiles along the edges of the table.

Here is one tabletop:



This square tabletop uses:
5 whole tiles, 4 half tiles, 4 quarter tiles.

Table Tiles

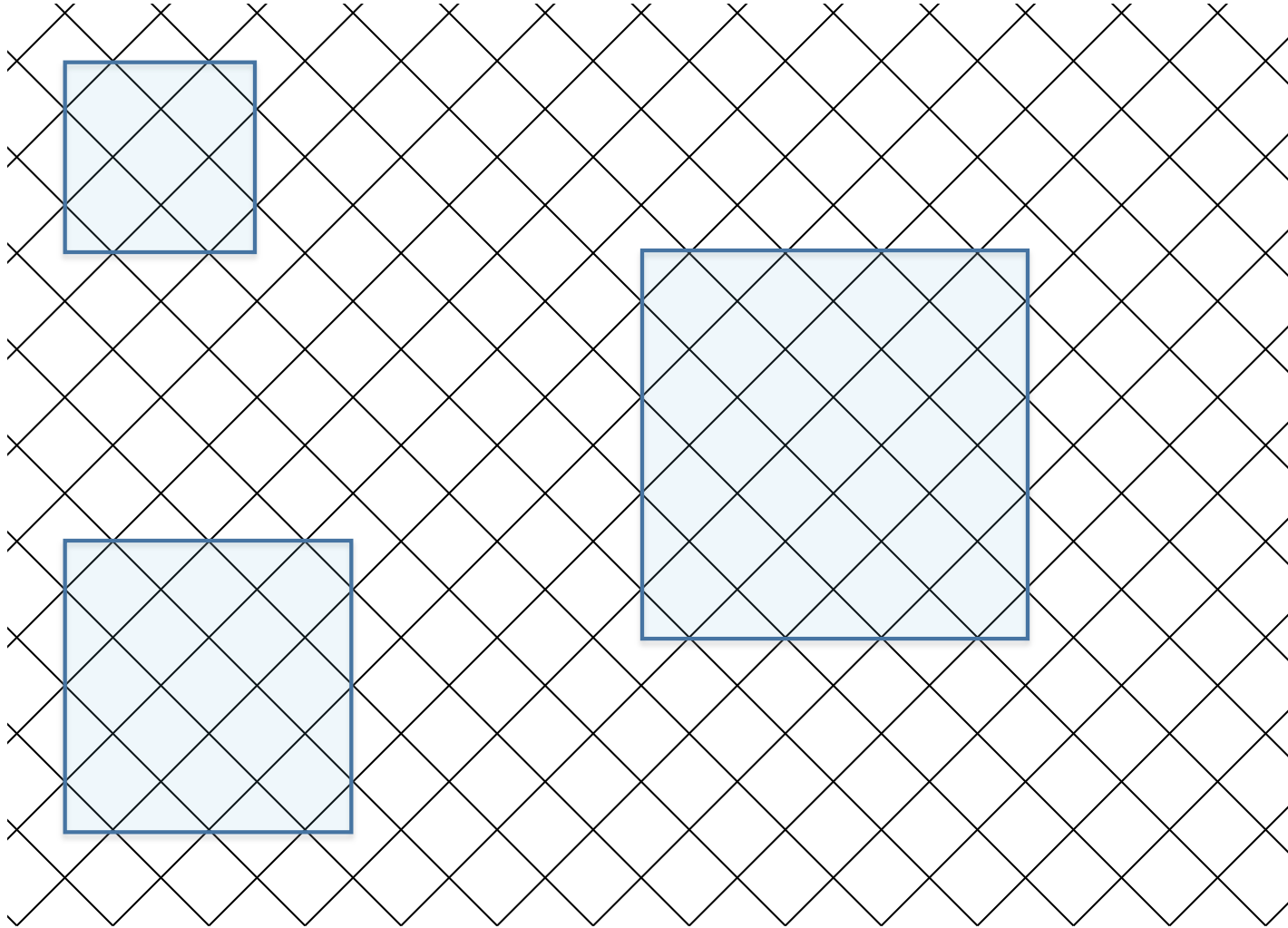
1. How many tiles of each type will she need for a 40 cm by 40 cm square?

2. Describe a method for calculating how many tiles of each type Maria needs for larger square tabletops.

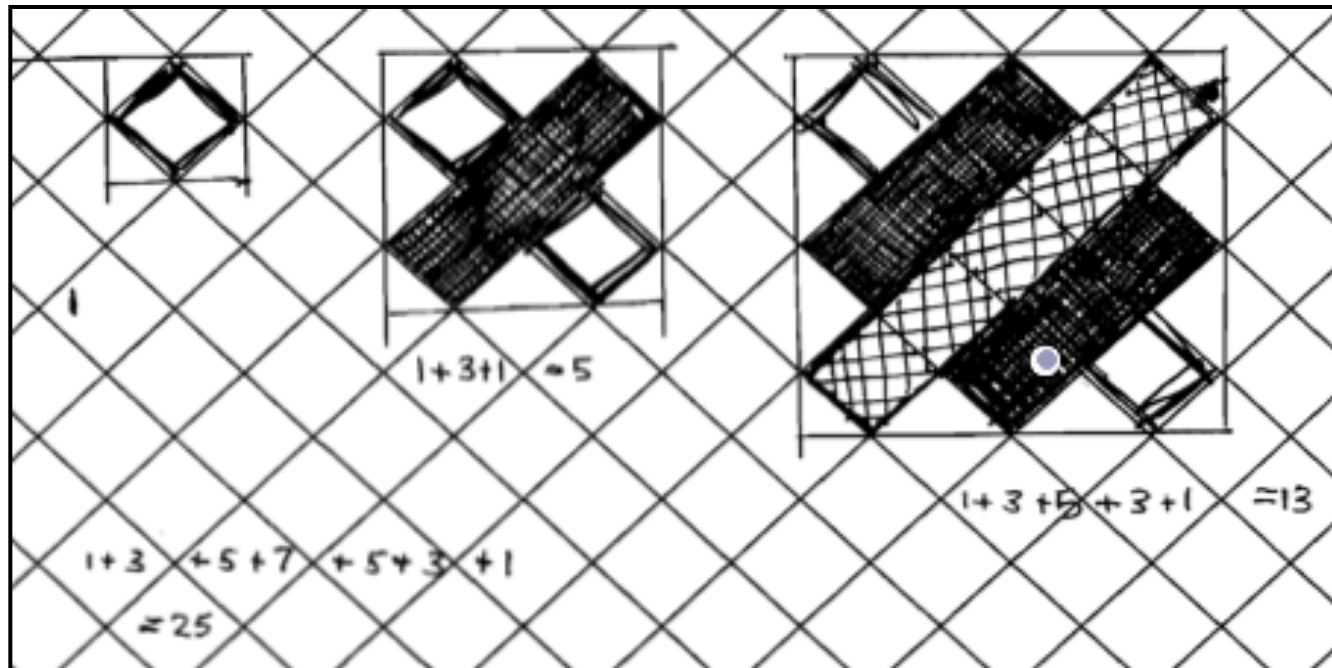
Student Responses to Discuss

1. Describe the problem solving approach the student used.
You might, for example:
 - Describe the way the student has colored the pattern of tiles.
 - Describe what the student did to calculate a sequence of numbers.
2. Explain what the student needs to do to complete his or her solution.

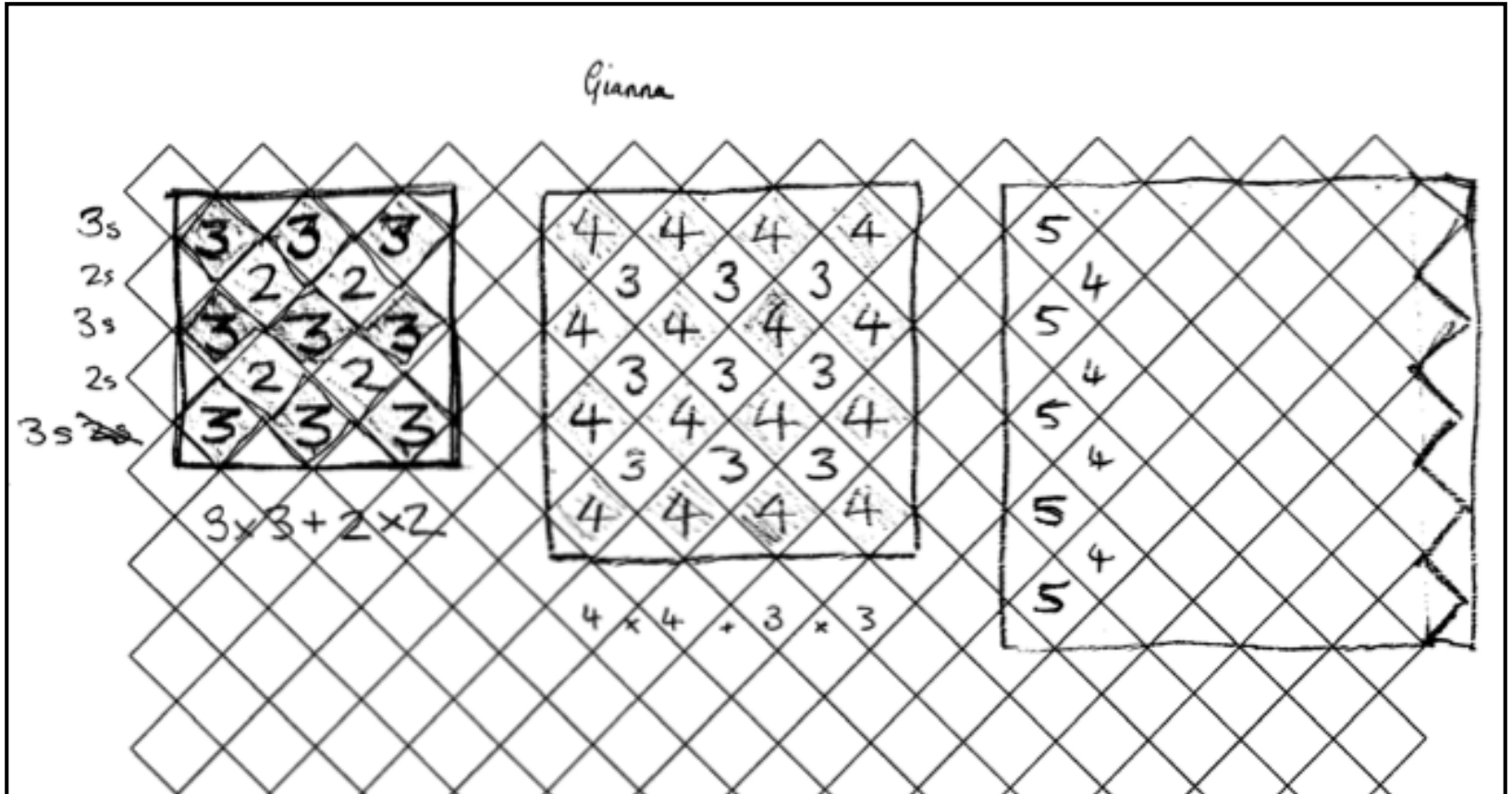
Tabletops



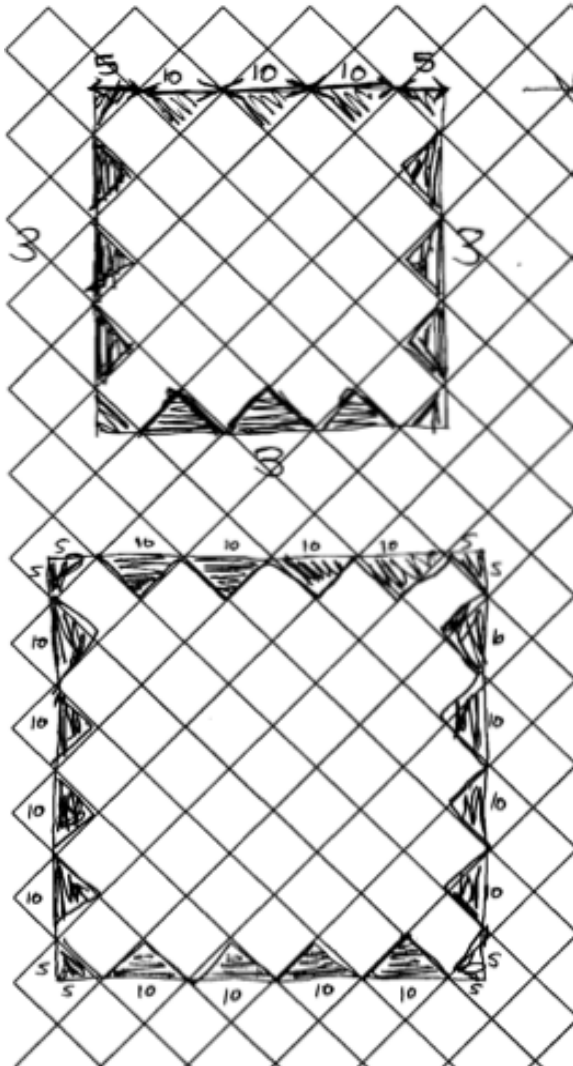
Leon's method



Gianna's method



Ava's method



Side length	10cm	20cm	30cm	40cm	50cm
Quarters	4	4	4	4	4
Half	0	4	8	12	16
Wholes	1	5	13	25	41

Handwritten annotations below the table show the progression of the 'Wholes' row:

- From 1 to 5: $+4$
- From 5 to 13: $+8$
- From 13 to 25: $+12$
- From 25 to 41: $+16$

Below these, the increments are shown as $+4$, $+4$, and $+4$, indicating that the increments themselves increase by 4 each step.

Summary

- What are you taking away from this workshop?
- What questions do you have?