Name Your Step

Purpose:
Participants will build a Step Pyramid of their own choice and analyze the blocks needed for each row and the total pyramid. These results will be compared with those of the single-step and two-step pyramids. This will lead to generalizations of the mathematics governing each of these pyramids and lend to greater geometric interpretations and representations of algebraic functions.

Overview:
In small groups, participants will build and explore a step pyramid of their own design, giving rise to multiple opportunities for mathematical modeling. They will have the option of using multiple representations for exploration including graphical, tabular and functional.

TExES Mathematics Competencies. The beginning teacher:

II.04.A Uses inductive reasoning to identify, extend, and create patterns using concrete models, figures, numbers, and algebraic expressions.
II.04.B Formulates implicit and explicit rules to describe and construct sequences verbally, numerically, graphically, and symbolically.
II.04.D Gives appropriate justification of the manipulation of algebraic expressions.
II.06.B Demonstrates an understanding of the connections among geometric, graphic, numeric, and symbolic representations of quadratic functions.
II.06.C Analyzes data and represents and solves problems involving exponential growth and decay.

TEKS Mathematics Objectives. The student is expected to:

5.06.A Describe relationships mathematically. The student is expected to select from and use diagrams and number sentences to represent real-life situations.
6.04. Generate formulas to represent relationships involving perimeter, area, volume of a rectangular prism, etc., from a table of data.
6.05 Formulate an equation from a problem situation.
6.8.B Select and use appropriate units, tools, or formulas to measure and to solve problems involving length (including perimeter and circumference), area, time, temperature, capacity, and weight.
7.2.C Use models to add, subtract, multiply, and divide integers and connect the actions to algorithms
7.4.A Generate formulas involving conversions, perimeter, area, circumference, volume, and scaling.
7.4.B Graph data to demonstrate relationships in familiar concepts such as conversions, perimeter, area, circumference, volume, and scaling
7.4.C Describe the relationship between the terms in a sequence and their positions in the sequence.

Terms.
Area, function, sequence

Materials.
For each small group of participants:

- Transparency
- Activity Sheet for each participant
- Centimeter cubes

Transparencies.

- *Name Your Step*

Activity Sheet(s).

- *Name Your Step*

Procedure:

Steps	Questions/Math Notes
1. Read aloud the *Name Your Step* Transparency two times. Allow participants to ask questions about the problem situation described. Ask participants to work in groups of 4 to use their centimeter cubes to build a step pyramid of the type described and to begin exploring some of the mathematics of the situation.	To stimulate reflection, ask participants build a table showing the number of blocks required for each row and the total required to build the pyramid of that many rows. Ask: *Is there a way to predict what happens in a 7 row pyramid? A 9 row pyramid?* *How do these findings compare with the earlier pyramids? (Encourage a table layout).*
2. Circulate among the groups as they work the problem. Encourage each group to complete their table of results until five rows of the pyramid are in place. Ask participants to graphically represent the changes in area using graph paper.	
3. Select several small groups to present their findings and graphics. Were they able to find a unifying approach to work for any type of step pyramid?	*How is your graphic reflected in the problem situation?* *Which portions of the functional representation are shown in your graphic?*

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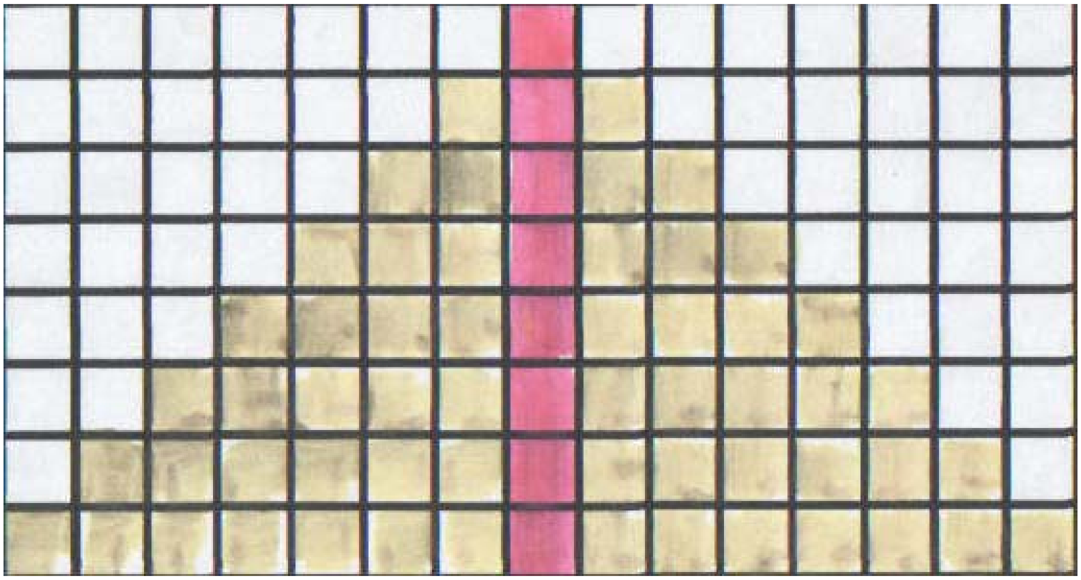
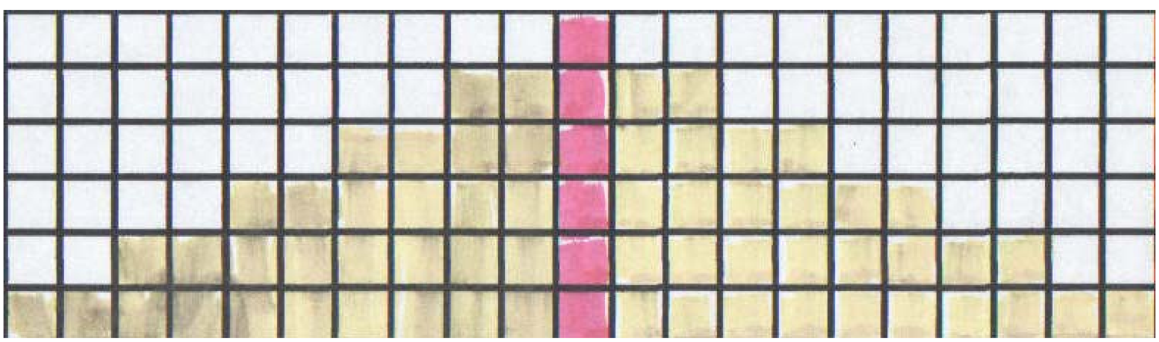
This activity draws heavily upon successful completion of the first two “Step-Pyramid” activities. As such, it is very important that sufficient time was spent to allow for successful completion of these preparatory activities.

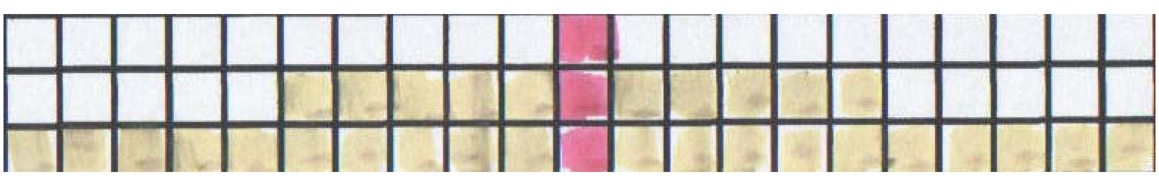
The same geometric methods of solution will apply for each of the pyramids which can be generated. The following examples show the cases for a step size of 1, 2, and 5.



Step Size = 1.



Step Size = 2.



Step Size = 5.

As these illustrations show for a step pyramid of step size **S** the number of blocks in any given row **R** must equal **2S(R-1)+1**.

Likewise, we can adopt the earlier techniques to find the total number of blocks in a step pyramid of step **S** for **R** rows to be **R[SR-(S-1)]**.

The following chart shows a typical set of observations leading to these findings:

Row	Step	Blocks in Row	Blocks in Pyramid
R	**1**	**2R-1**	**R*R**
R	**2**	**4(R-1)+1**	**R(2R-1)**
R	**3**	**6(R-1)+1**	**R(3R-2)**
R	**4**	**8(R-1)+1**	**R(4R-3)**
R	**5**	**10(R-1)+1**	**R(5R-4)**
R	**S**	**2S(R-1)+1**	**R(SR-(S-1))**

This activity allows the student to see how one set of findings can be used to generate a more generalizable function of much greater power and utility.