Growing Letters as Mathematical Models to Build Student Algebraic Understanding

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Principles to Actions (Theoretical Framework)

- Multiple representations
  - Bruner
  - Lesh
- Activity
- Student work
- Teaches:
  - Linear equations
  - Arithmetic sequences
  - Slope
  - Intercept

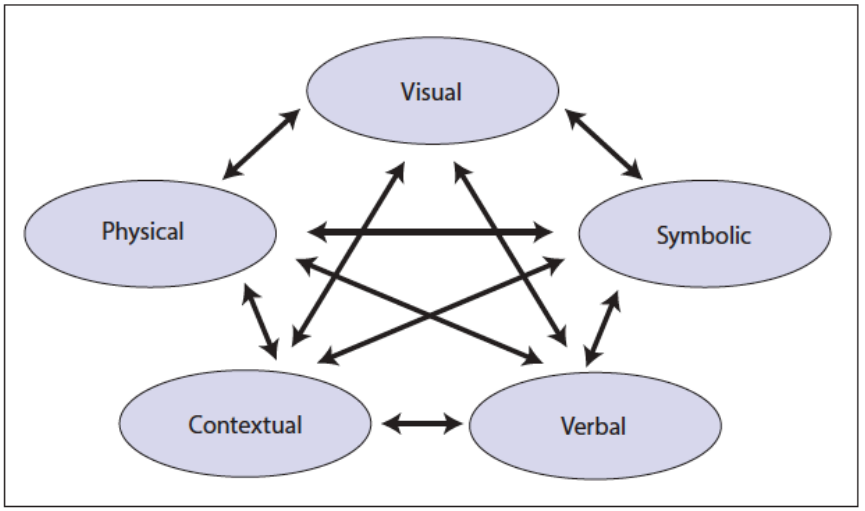
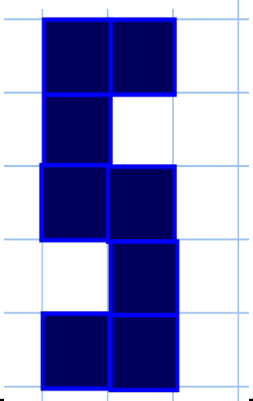


Fig. 9. Important connections among mathematical representations

The Growing Letter S

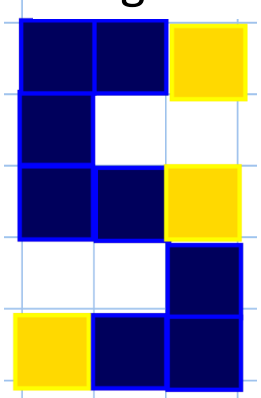
- Concrete examples (from Abe)

Stage 1



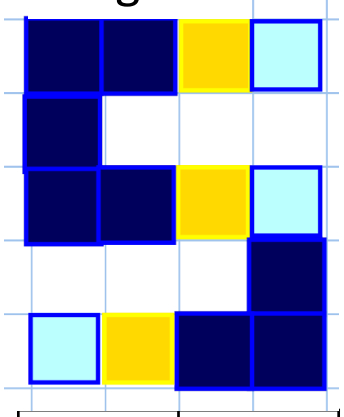
Stage	Value
0	
1	
2	
3	

Stage 2



Stage	Value
0	
1	
2	
3	

Stage 3



Stage	Value
0	
1	
2	
3	

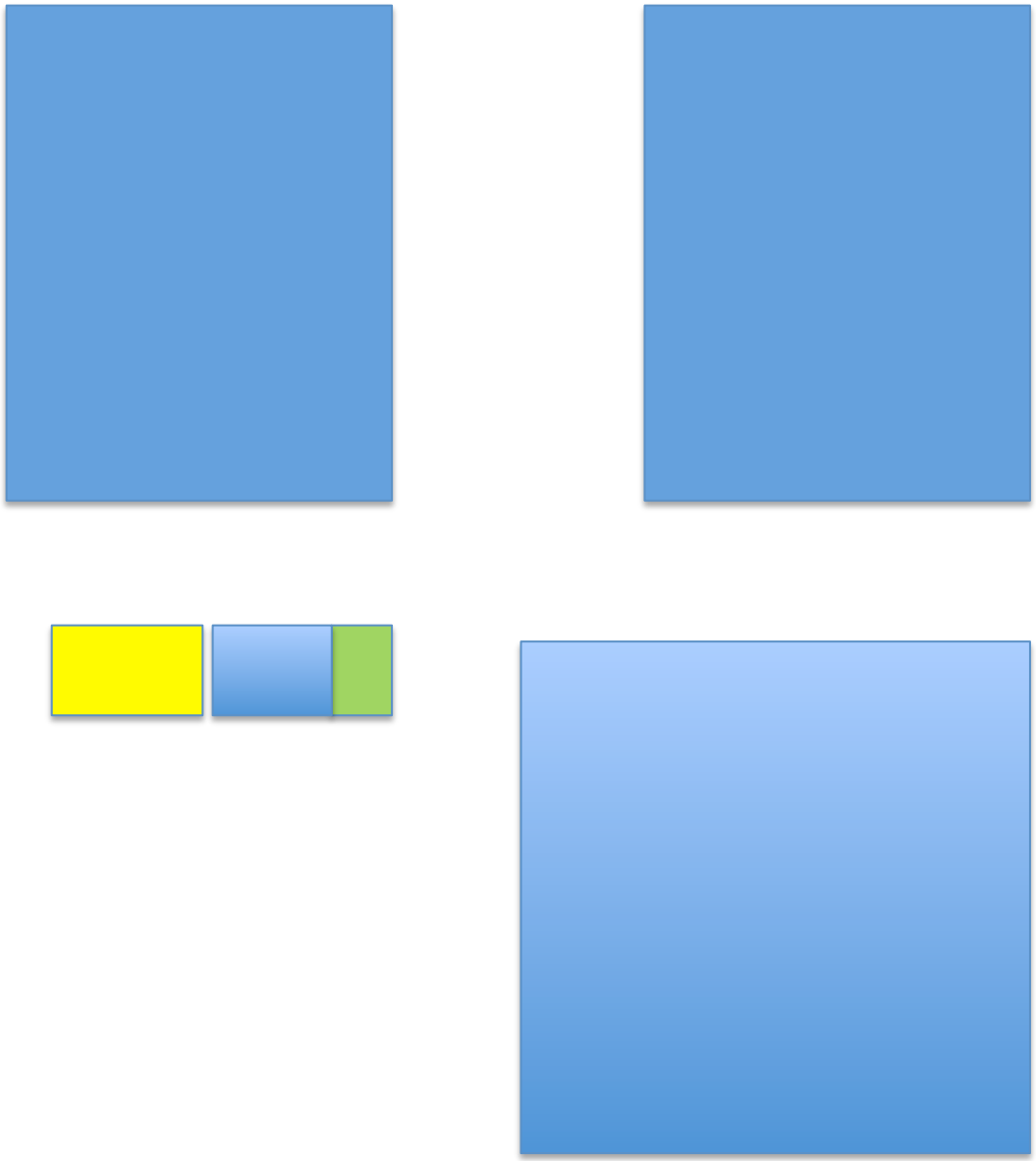
You grow **your** favorite letter

- Using the graph paper to grow your letter
- Record on a table the number of tiles used for each iteration (stage) as your letter grows
- Grow at least three iterations

Abe, Abe, how does your letter grow?

1. Abe constructed a table for first 3 stages

Stage	Value	Difference
0		
1	8	
2	11	
3	14	
4		

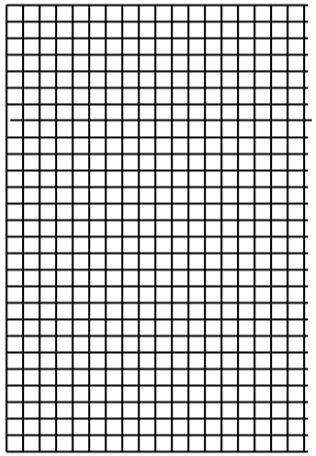


So now, how does your letter grow?

- You have the first three completed. Can you predict what the fourth number will be? Write down your guess on your table.
- Construct a recursive equation to model the growing pattern. Next =
- Build the fourth letter. Was your guess correct? Check with neighbor.

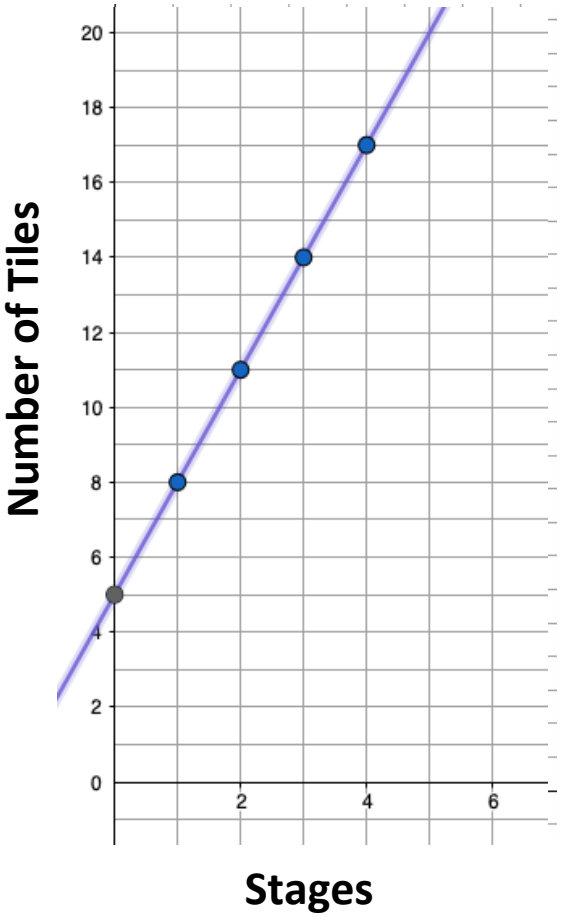
Algebra Four Square

- Table
- Written description and Picture
- Graph
- Equation

Table	Written Description (Picture)
Stage | Value | 1 | 2 | 3 | 4 | n |	
Graph	**Equation**
	

Make a graph from your table

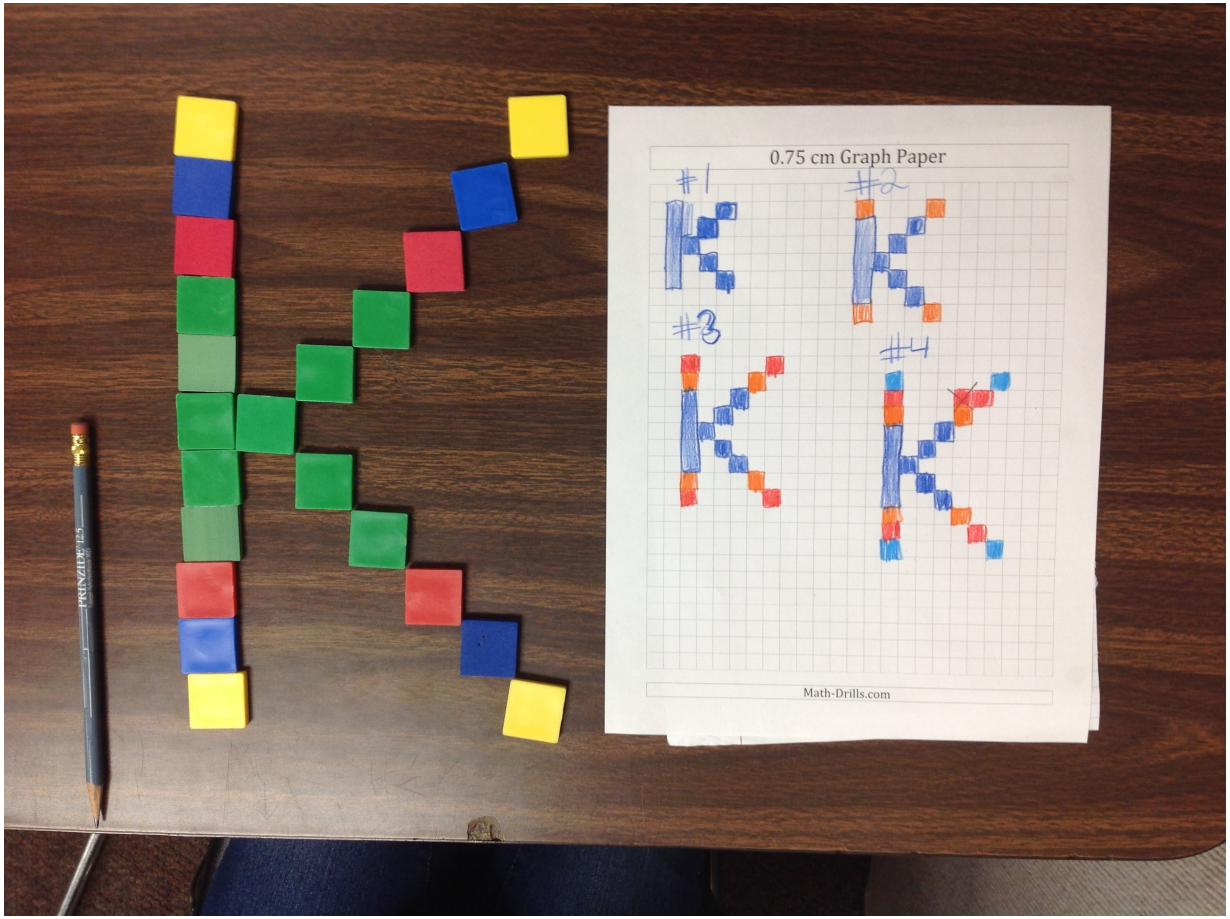
- Abe's Graph



Compare the room

- Arithmetic sequence is a sequence of numbers such that the difference between two consecutive terms is constant (Wikipedia).
- How many have something that models an arithmetic sequence?
- How many have a graph that is a straight line?
- How many have a graph that is not a straight line?

Examples of student work



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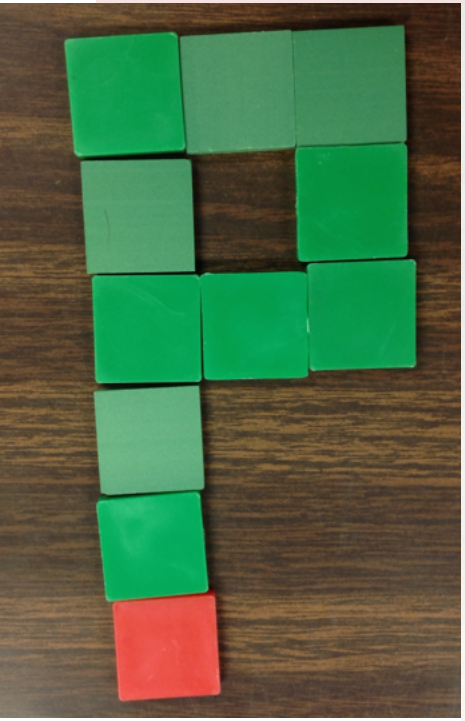

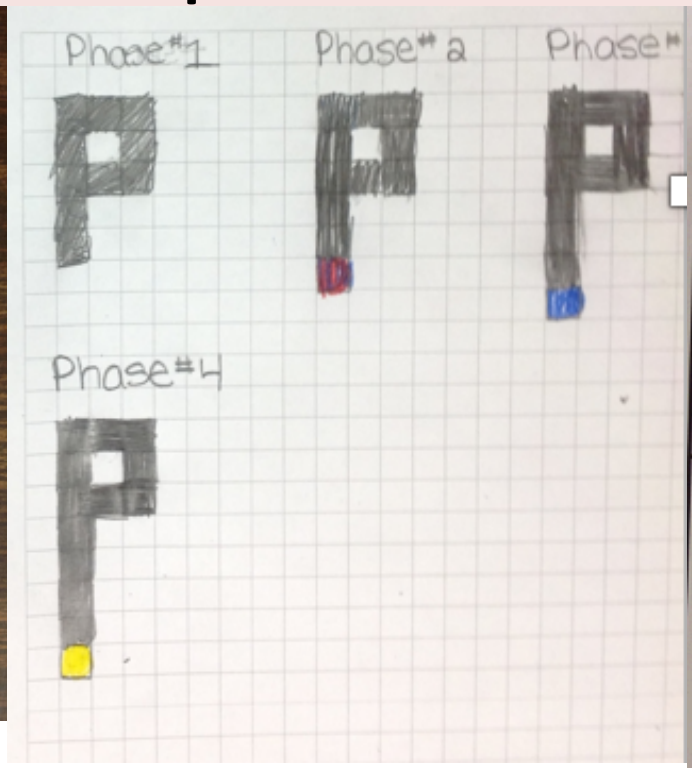

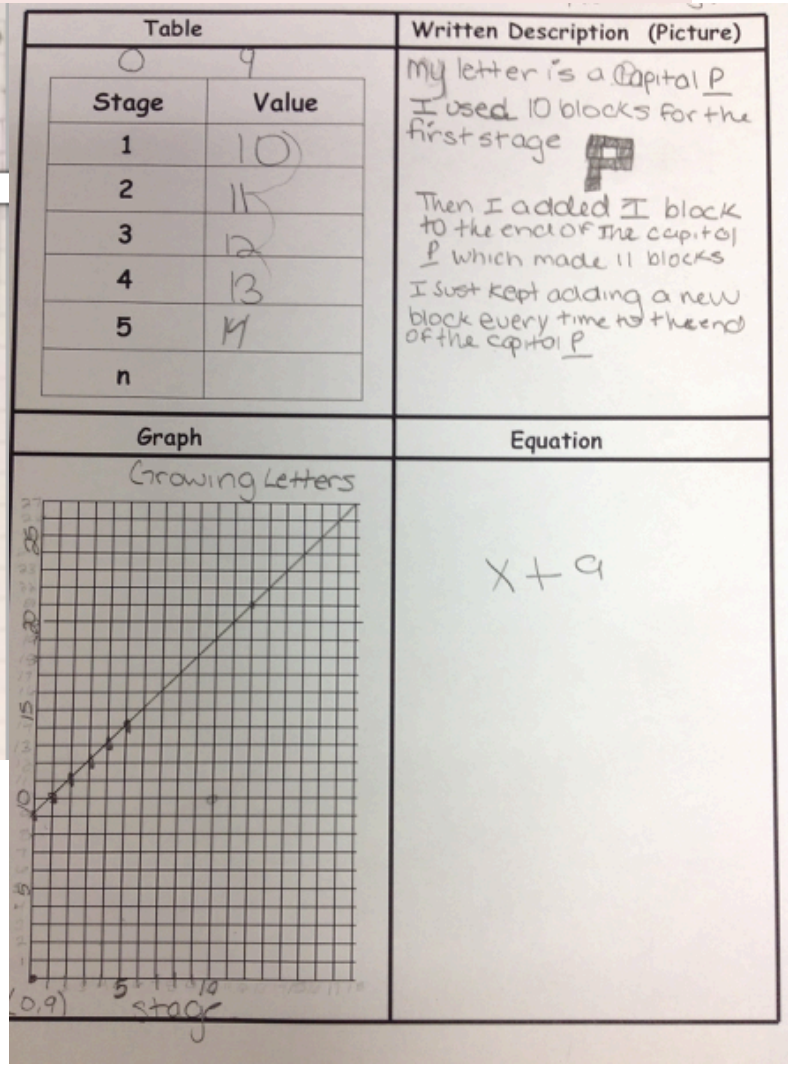

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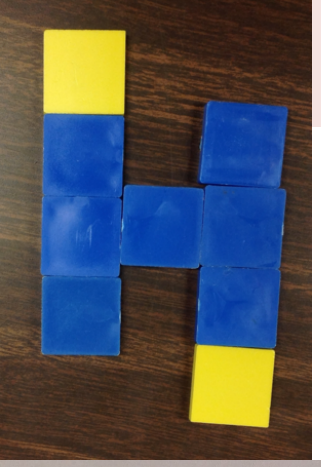

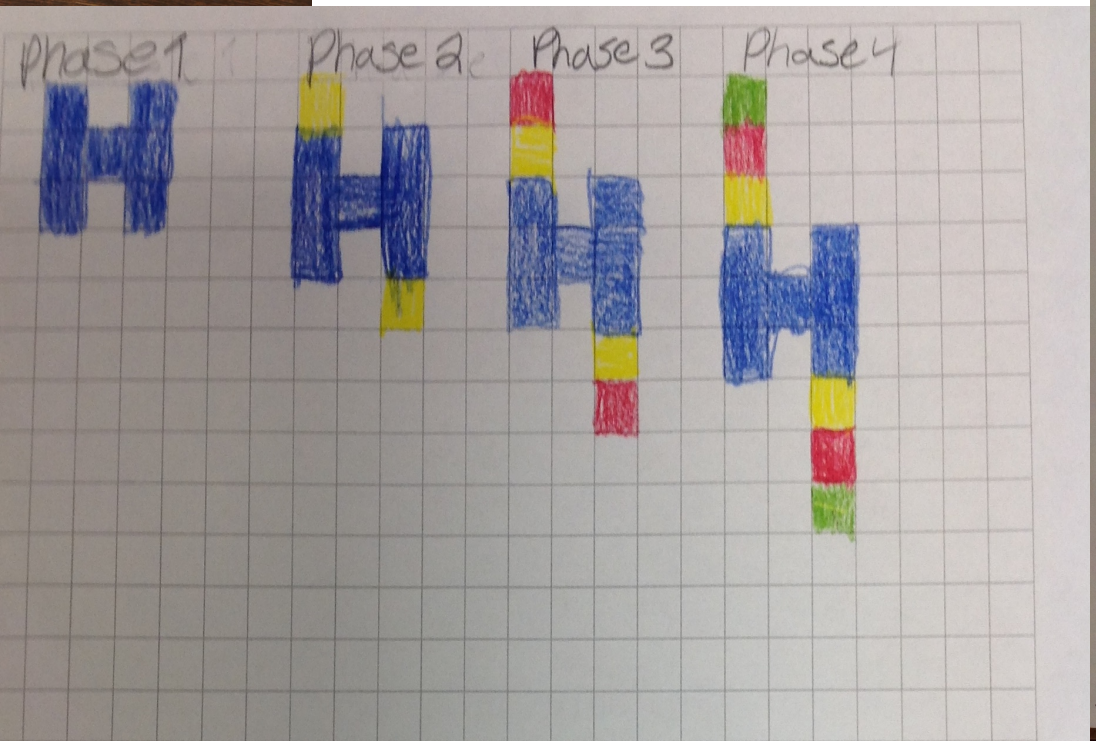

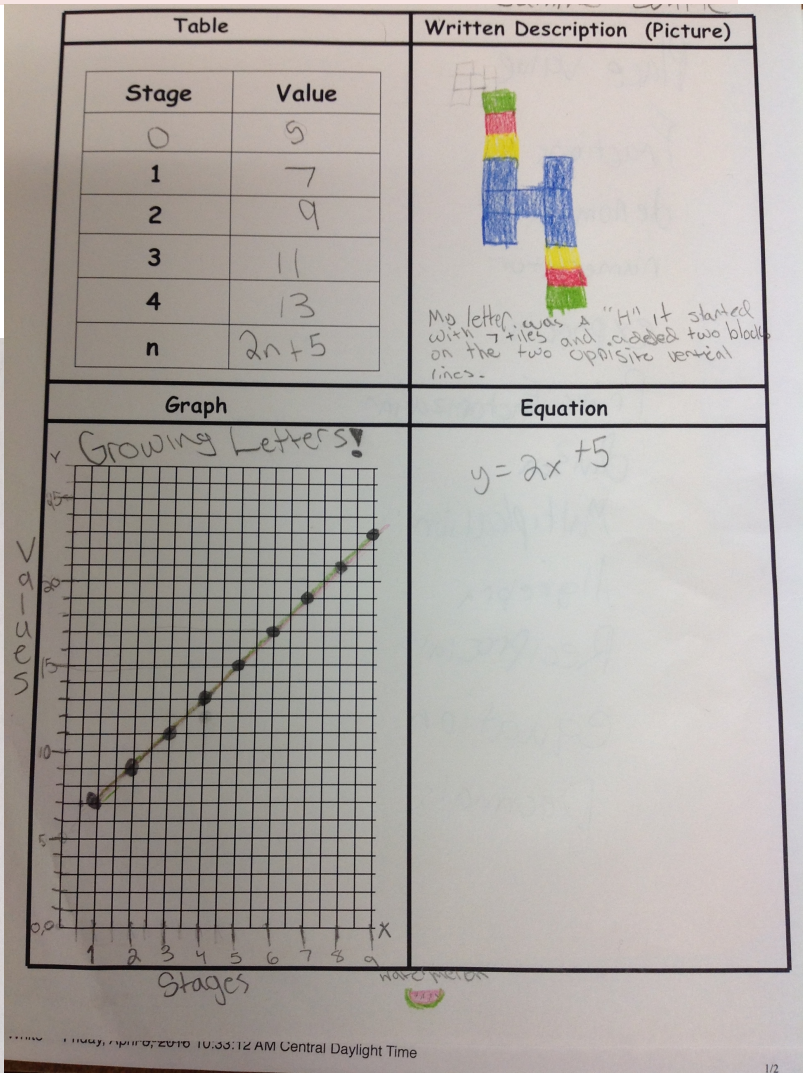

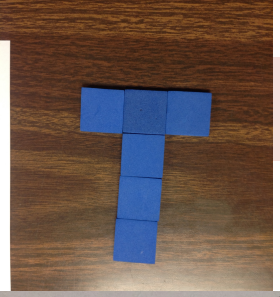

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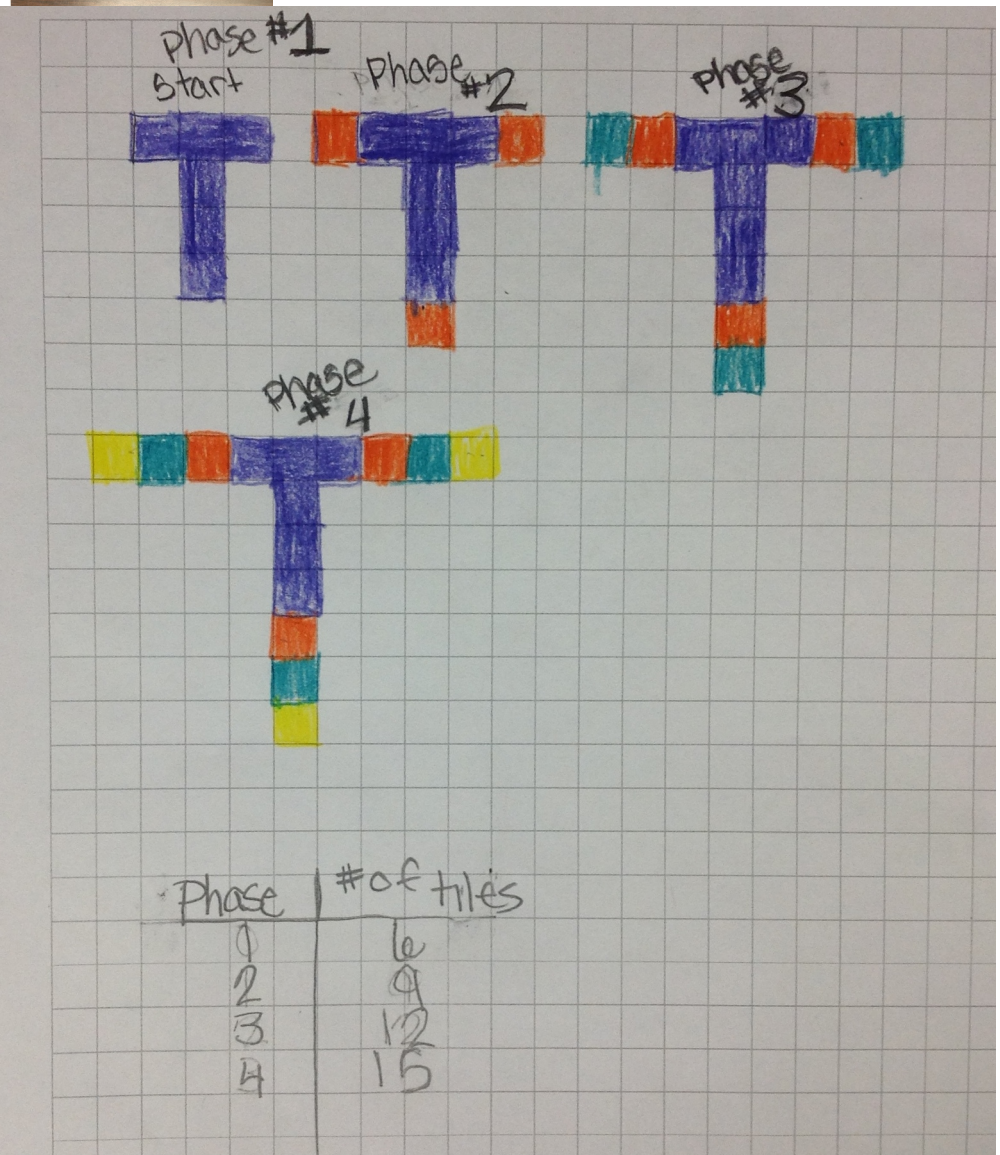
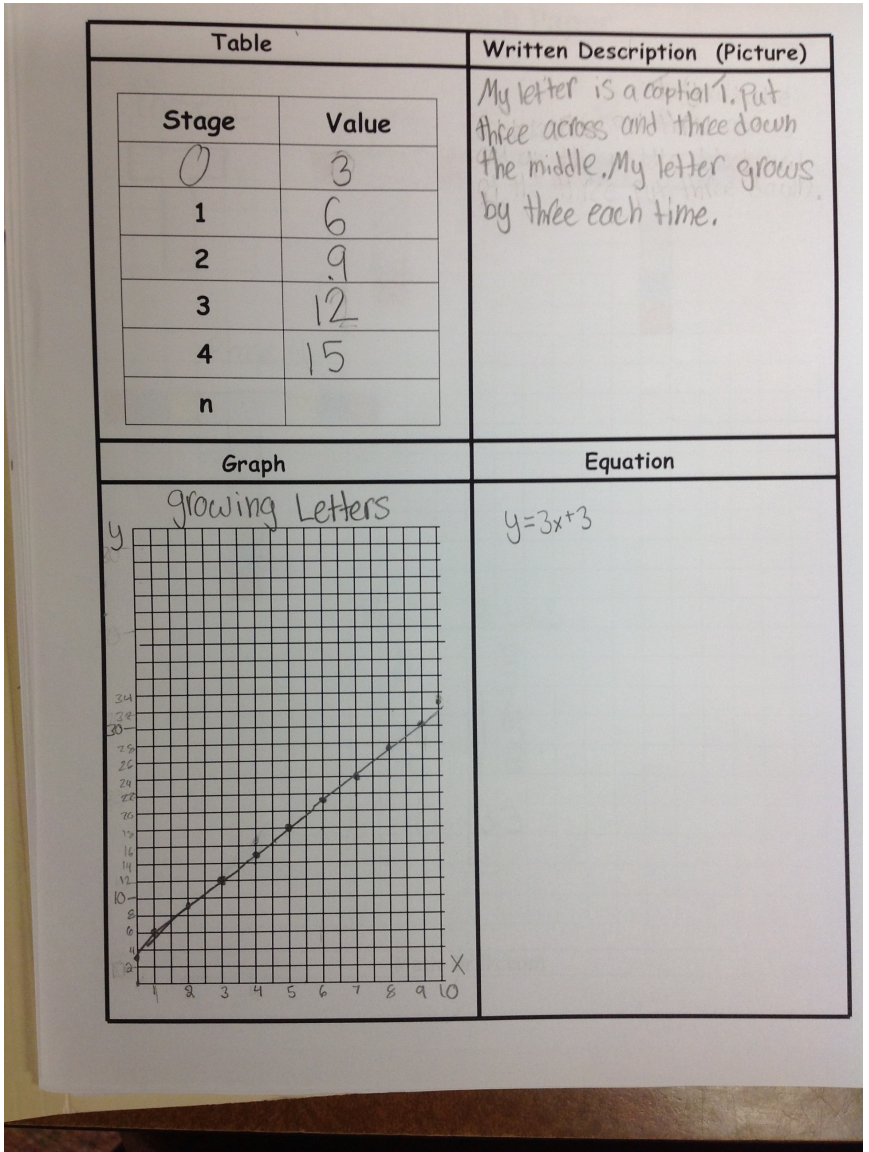




Principles to Actions (Theoretical Framework)

Pictures **Graphs**

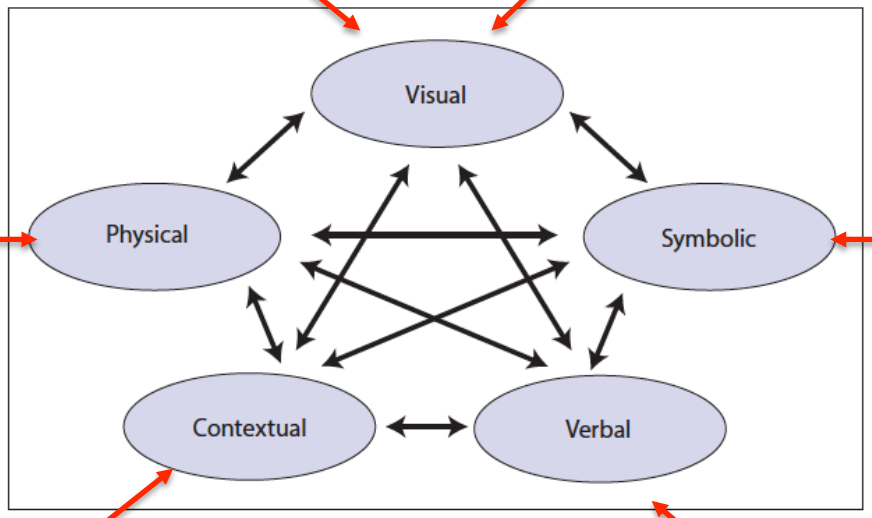


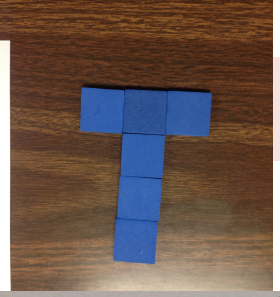
Fig. 9. Important connections among mathematical representations

Tiles

Recursive and Explicit Formulas

Growing Letters

Written Description



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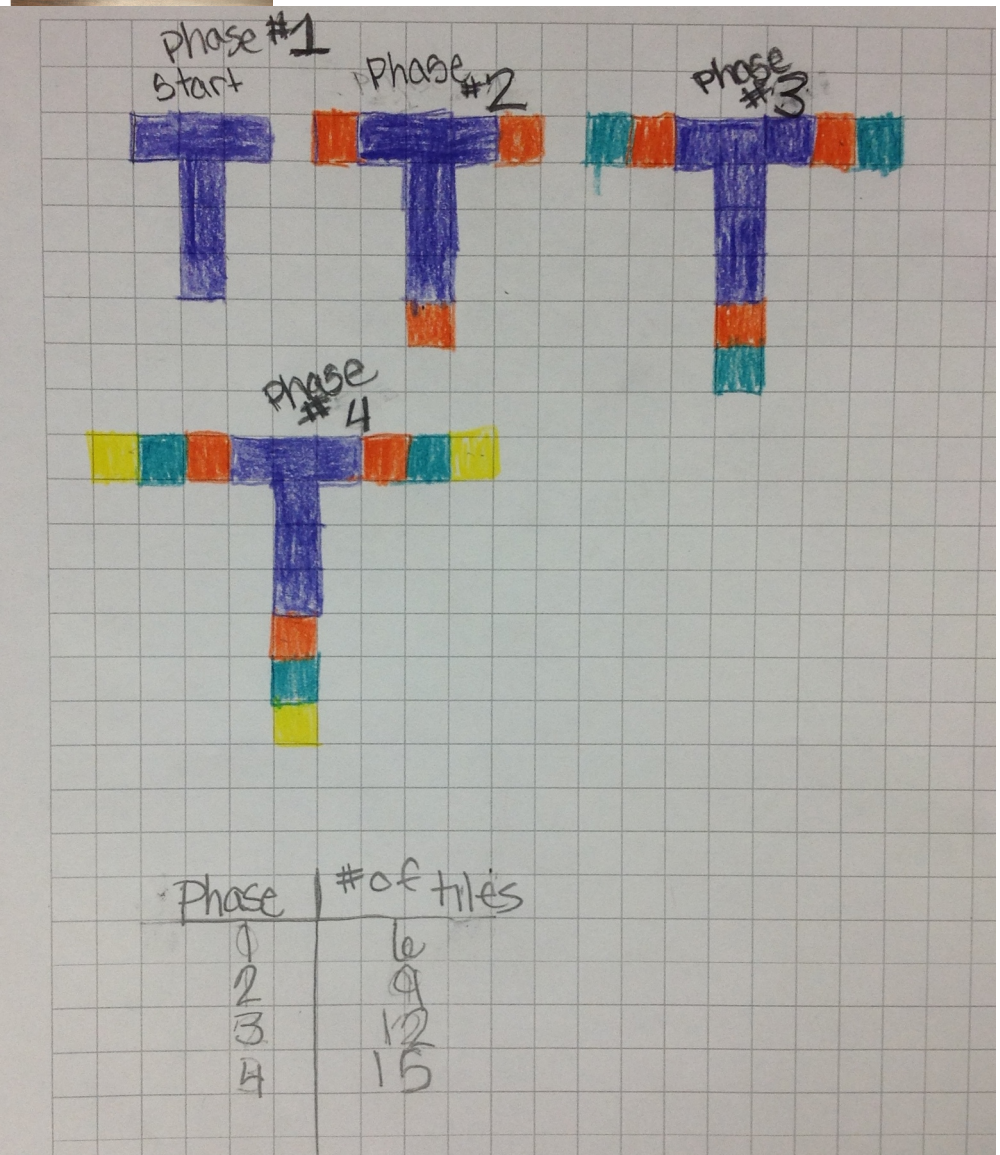
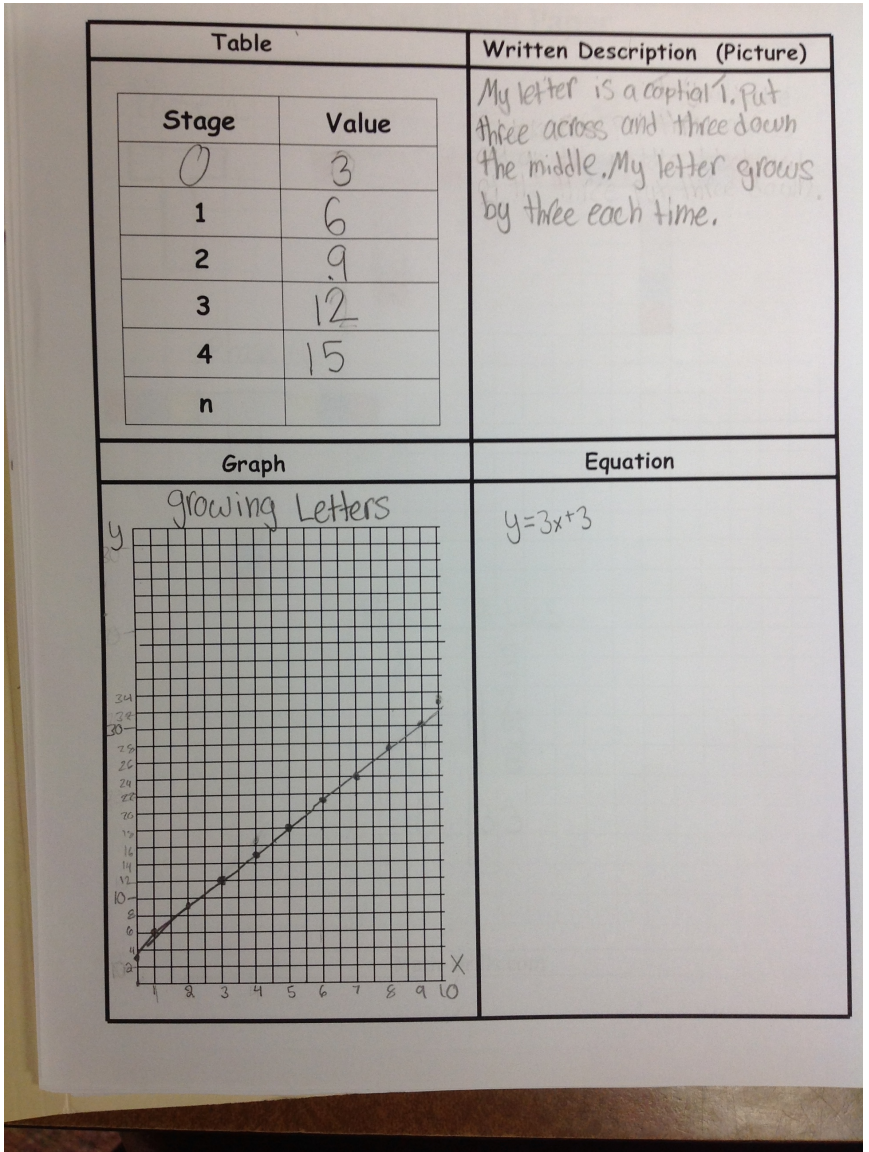
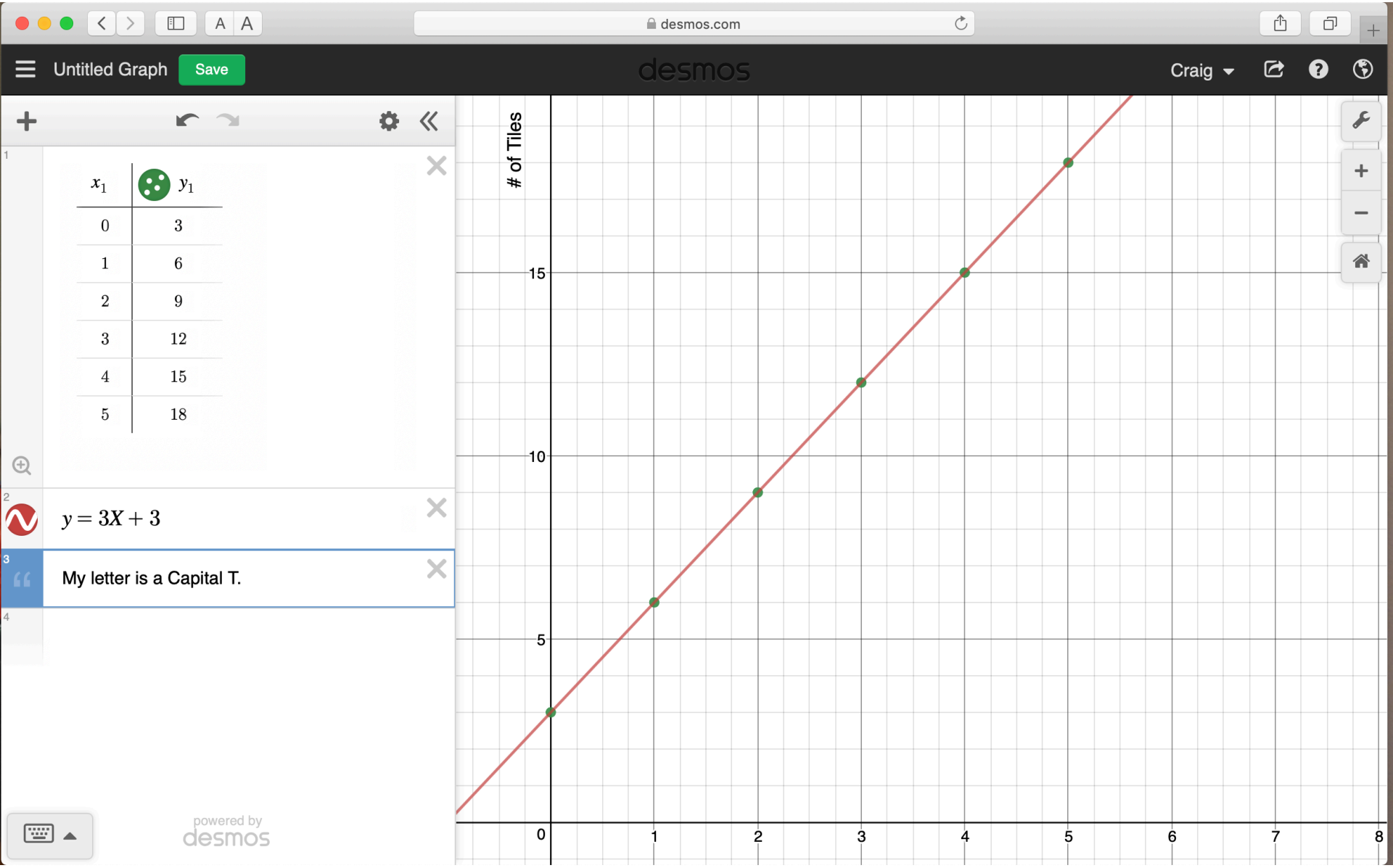




CAPITAL LETTER T



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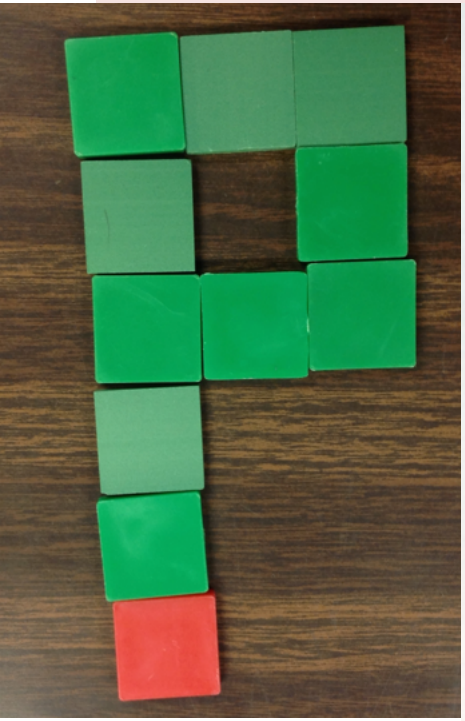
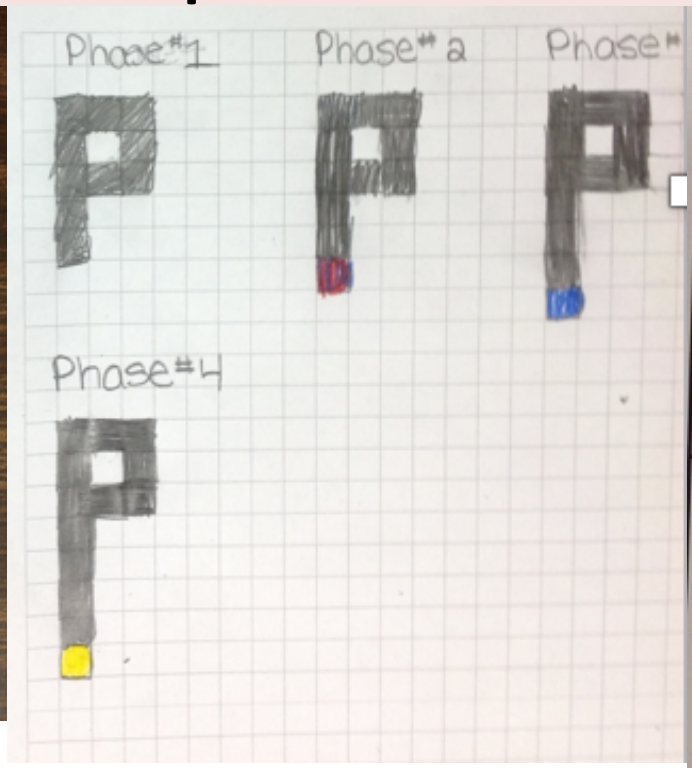
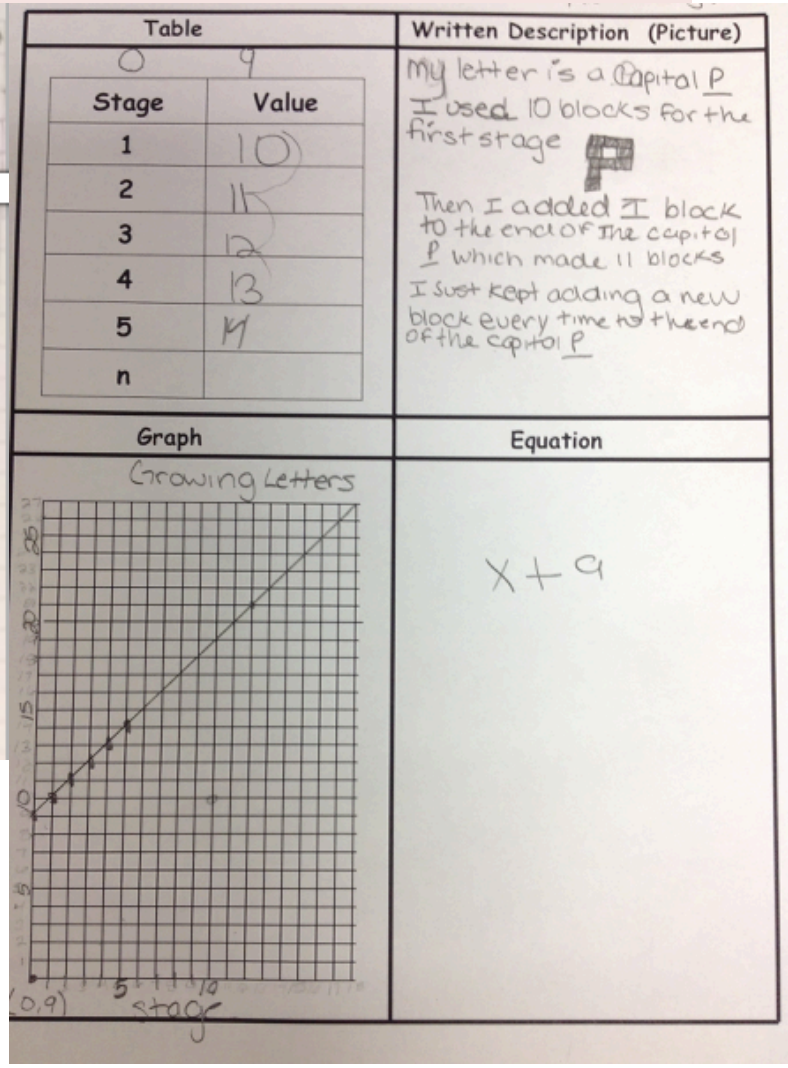
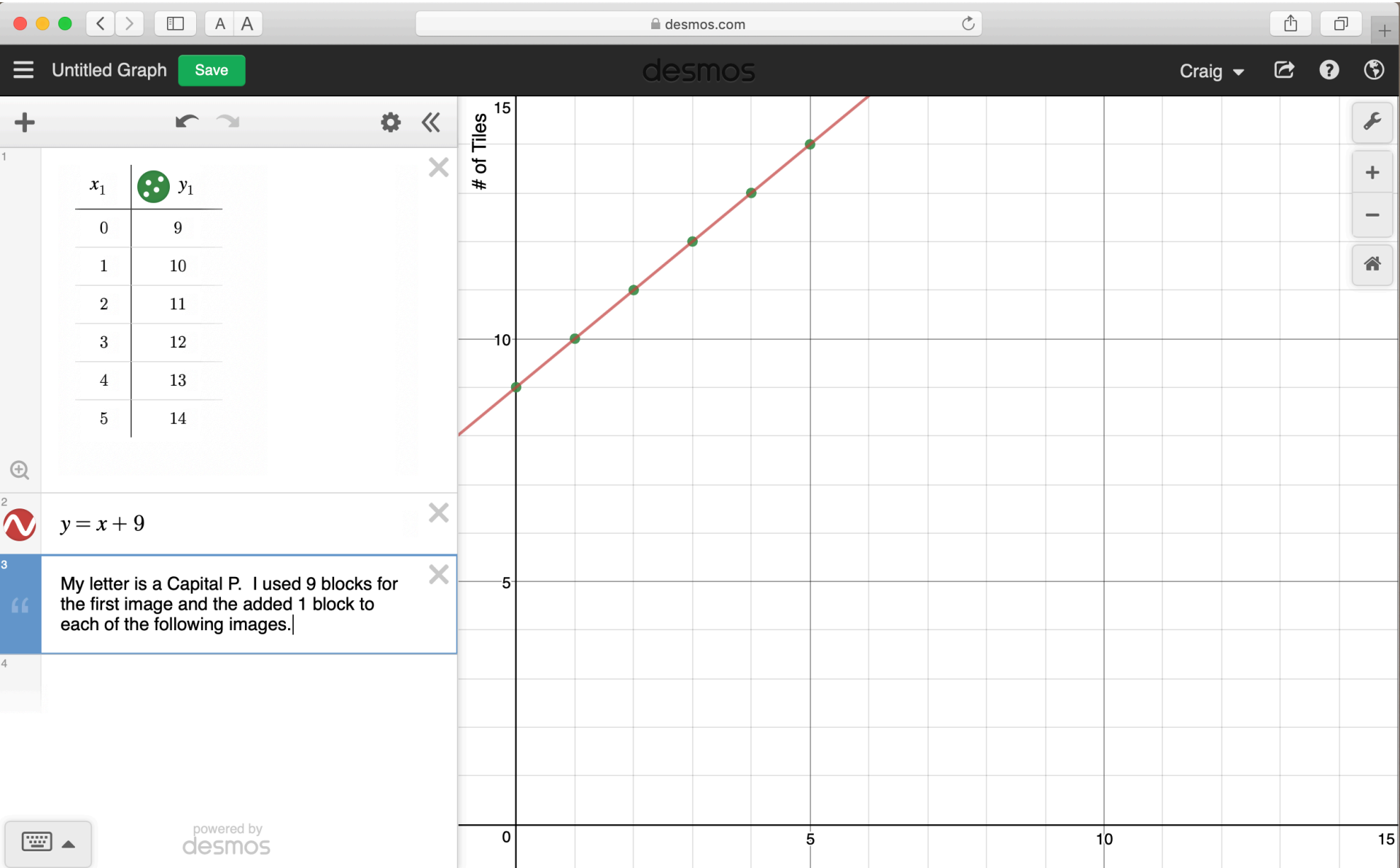


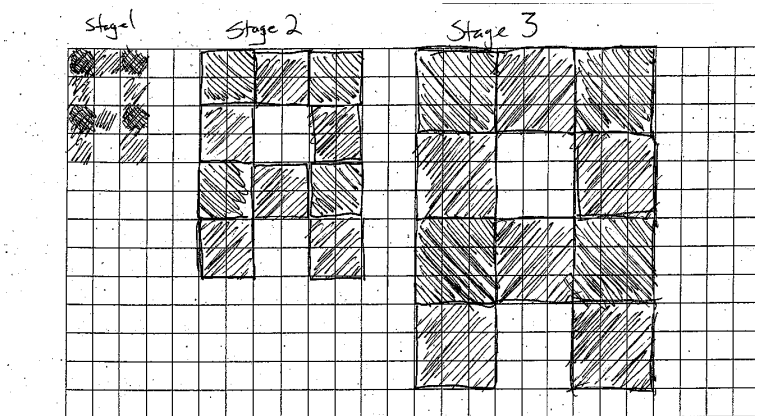




CAPITAL LETTER P



Extensions



Try a growing A.

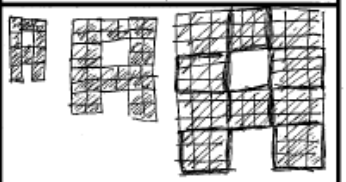
Is this what exponential growth looks like?

(HINT: No this is not exponential growth!)

Table

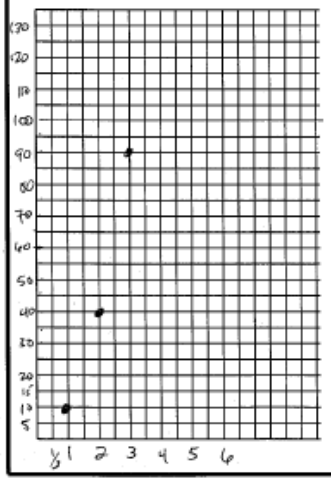
Stage	Value
1	10
2	40
3	90
4	
n	

Written Description (Picture)



Ten growing squares in the shape of an A.

Graph



Equation

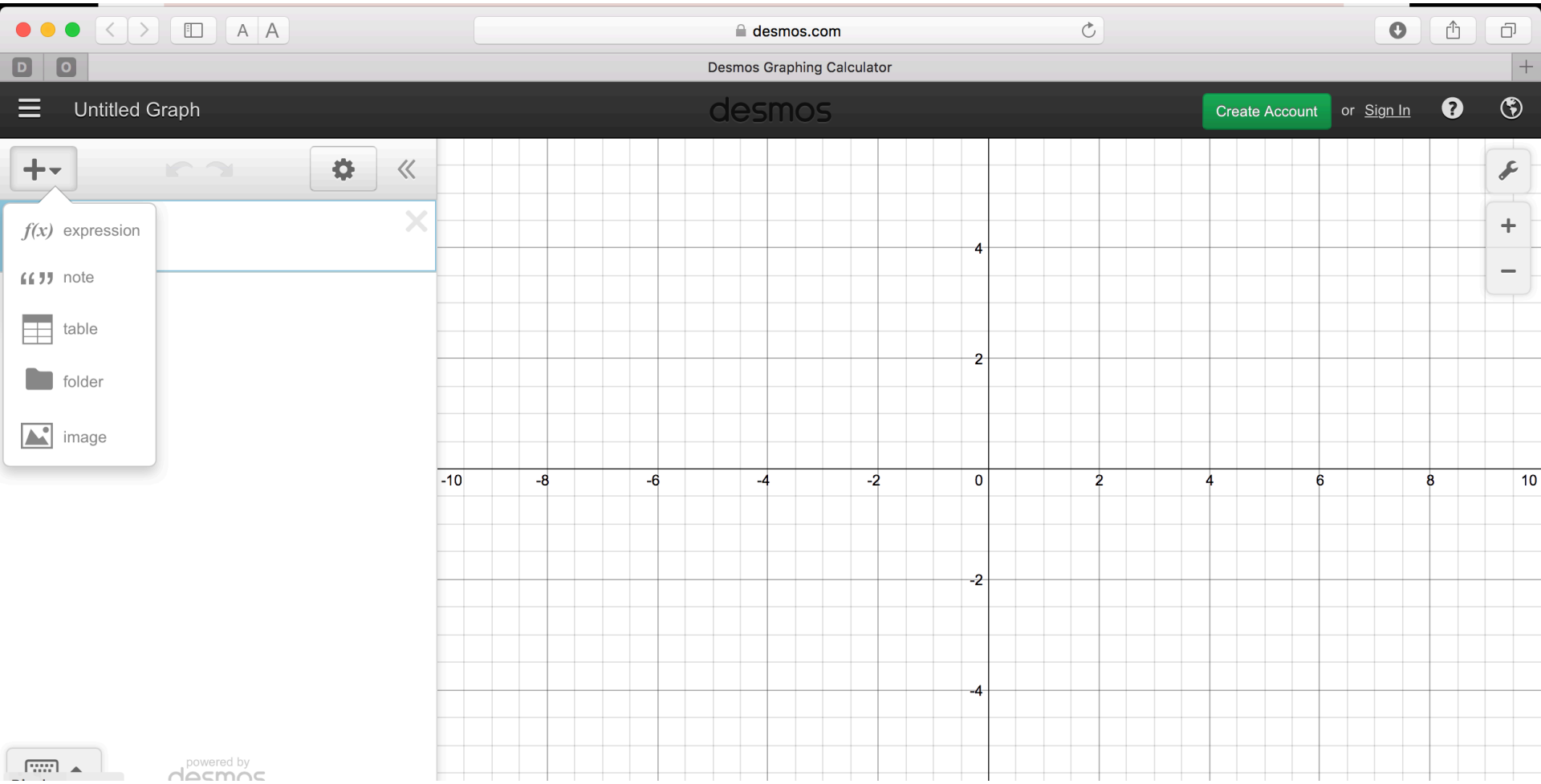
$Next = Now + (Now - Prev) + 20$

$Next = 2Now - Prev + 20$

$B = 10A^2 + 0$

Resources

Desmos



Resources

Geogebra