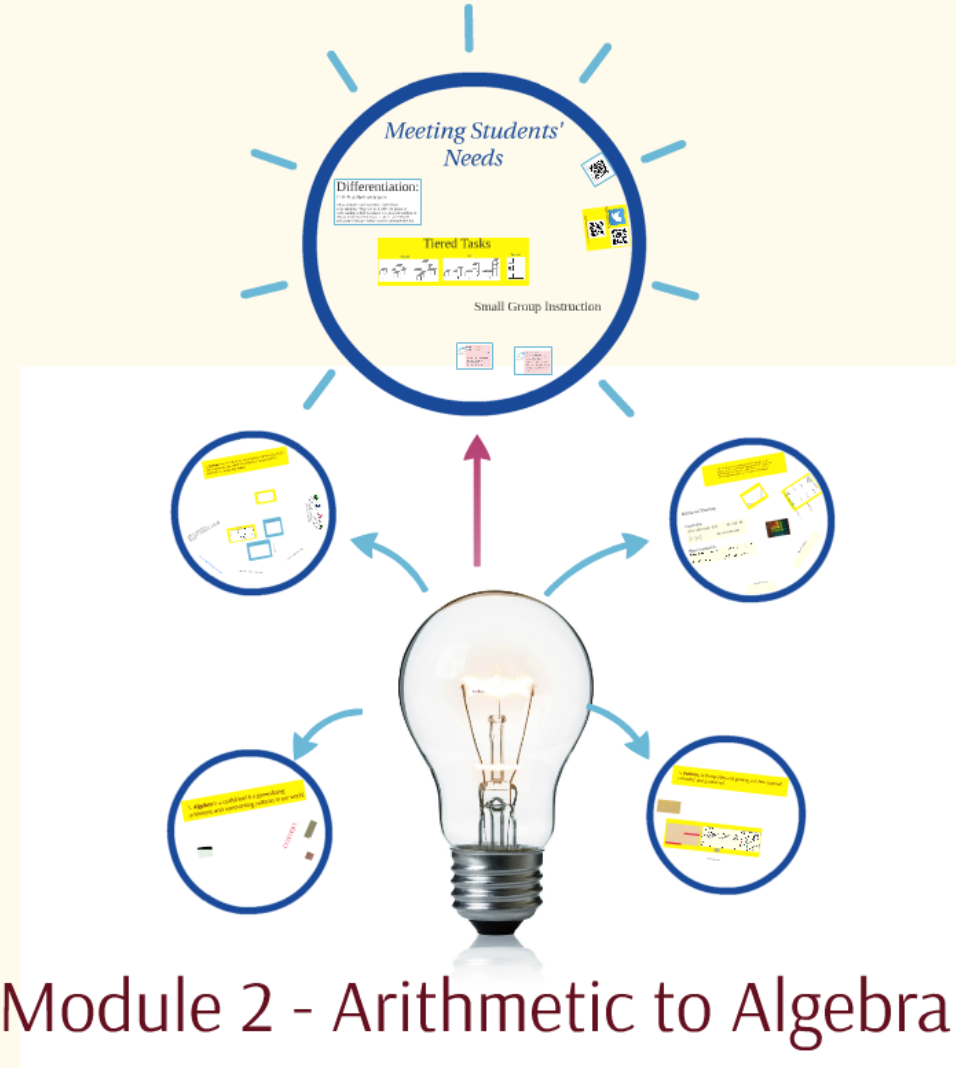
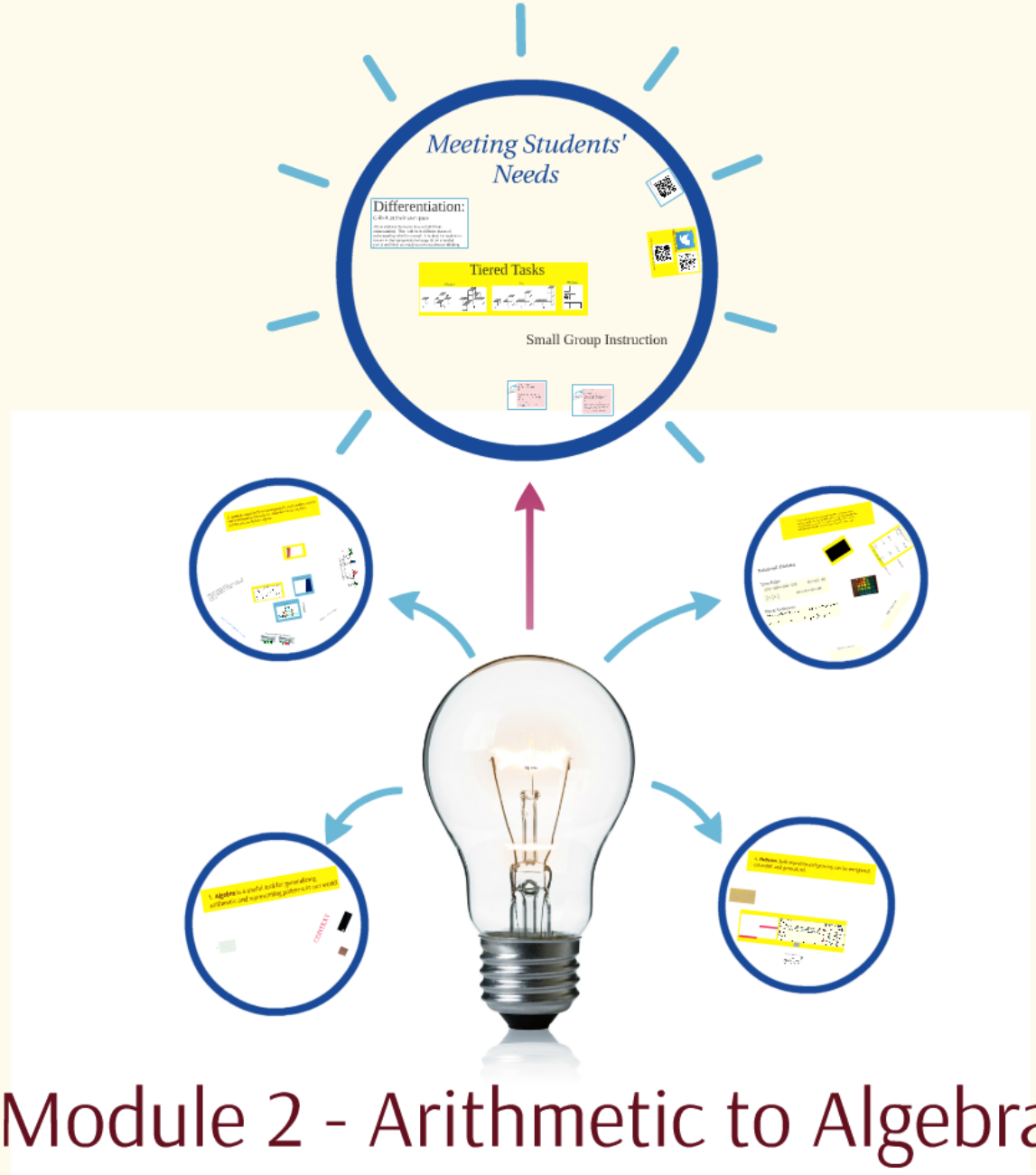


Module 2 - Arithmetic to Algebra

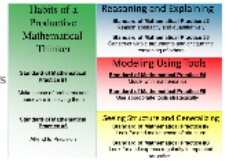


Module 2 - Arithmetic to Algebra

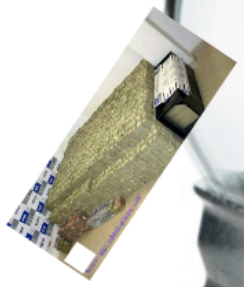
Big Ideas

1. ***Algebra*** is a useful tool for generalizing arithmetic and representing patterns in our world.

SMPs



CONTEXT



Habits of a Productive Mathematical Thinker

Standard of Mathematical Practice #1

Make sense of problems and persevere in solving them

Standard of Mathematical Practice #6

Attend to Precision

Reasoning and Explaining

Standard of Mathematical Practice #2
Reason abstractly and quantitatively

Standard of Mathematical Practice #3
Construct viable arguments and critique the reasoning of others

Modeling Using Tools

Standard of Mathematical Practice #4
Model with mathematics

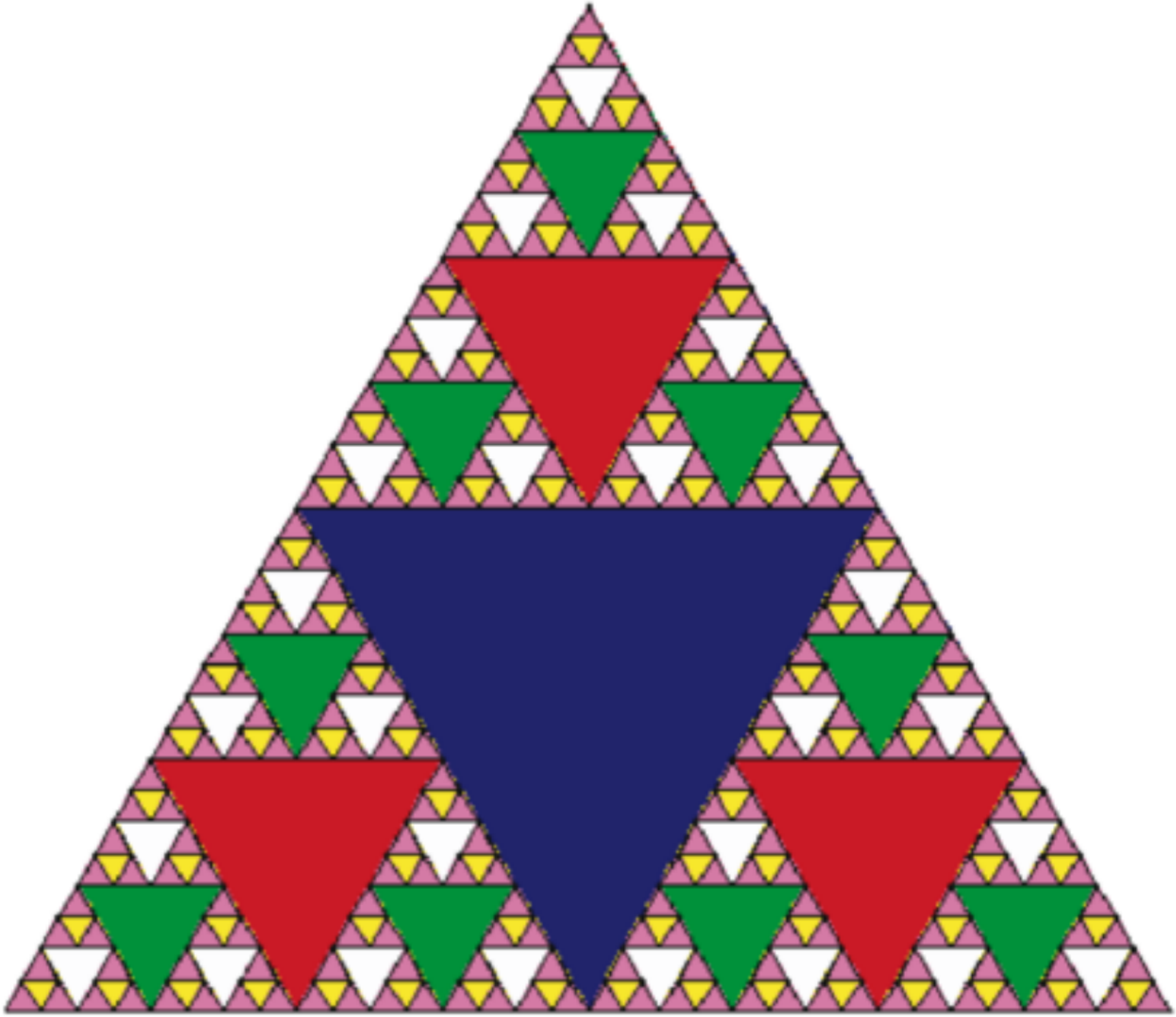
Standard of Mathematical Practice #5
Use appropriate tools strategically

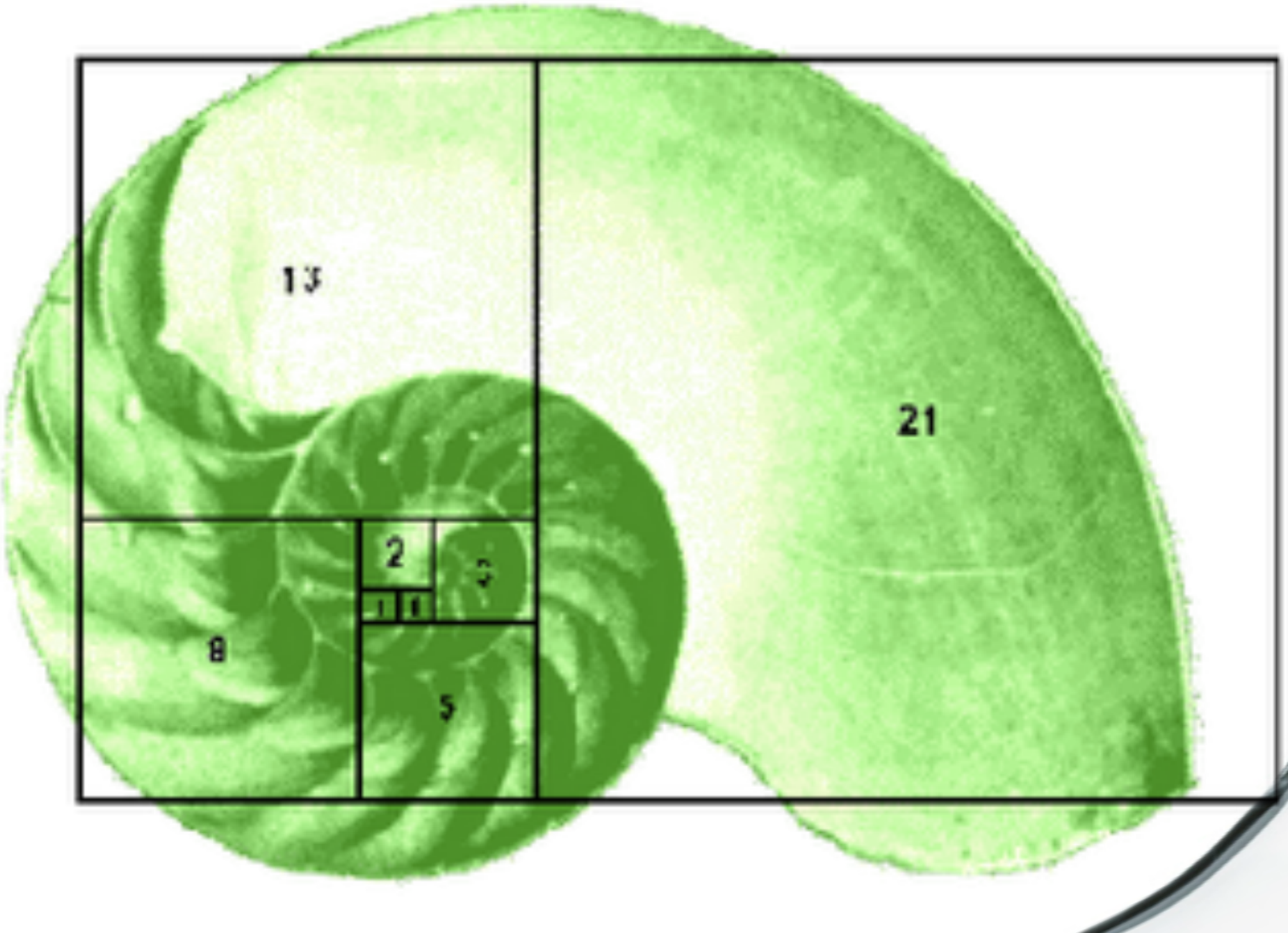
Seeing Structure and Generalizing

Standard of Mathematical Practice #7
Look for and make sense of structure

Standard of Mathematical Practice #8
Look for and express regularity in repeated reasoning

CONTEXT



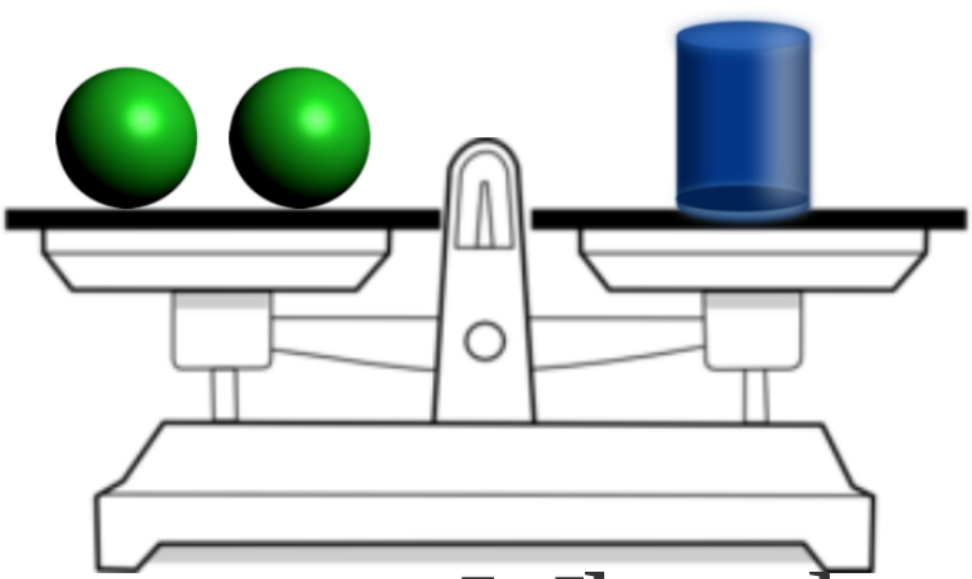

13
21
2
8
5

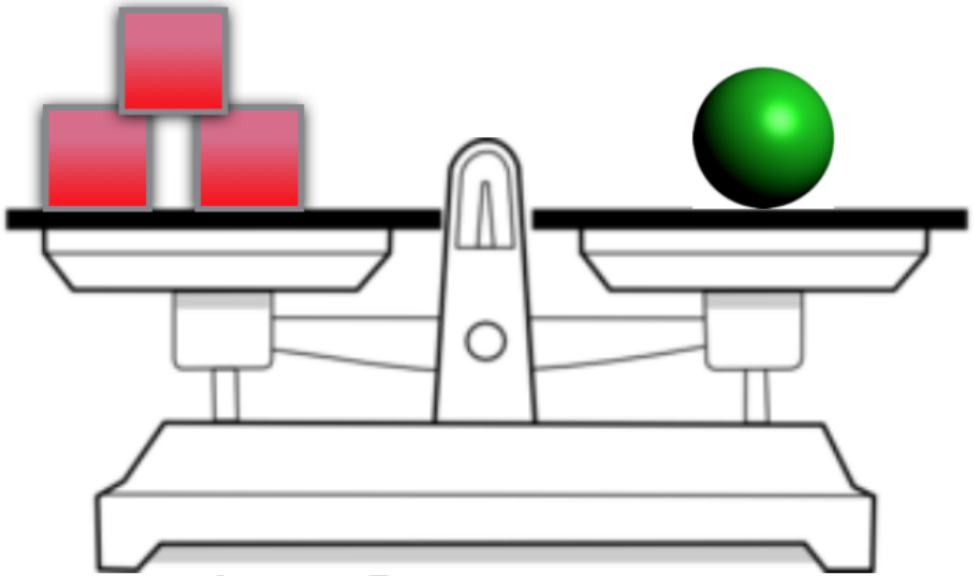
Source: http://robertkaplinsky.com/

Source: https://mikewiernicki.com/

CONTEXT

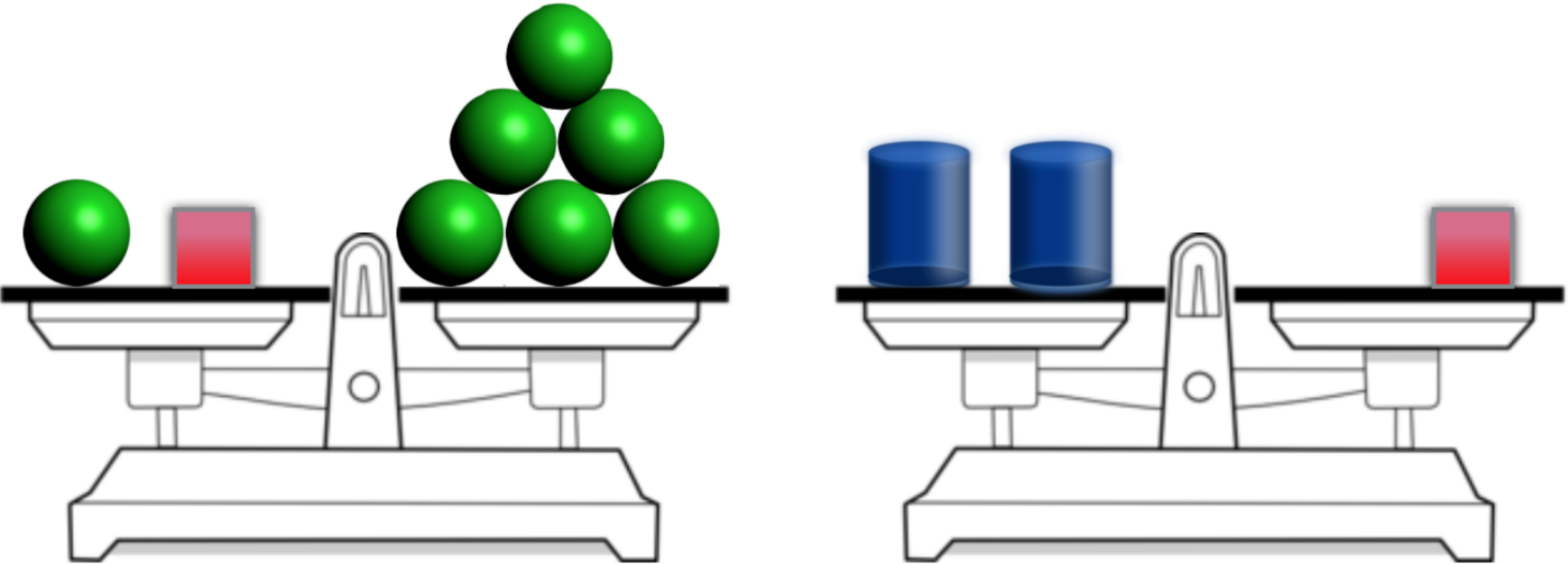
2. ***Symbols***, especially those involving equality and variables, must be well understood conceptually for students to be successful in mathematics, particularly algebra.



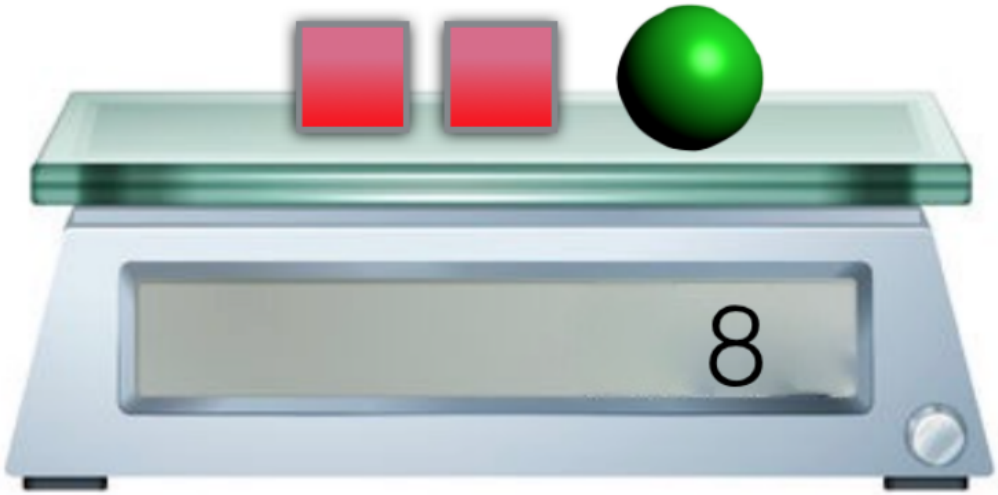


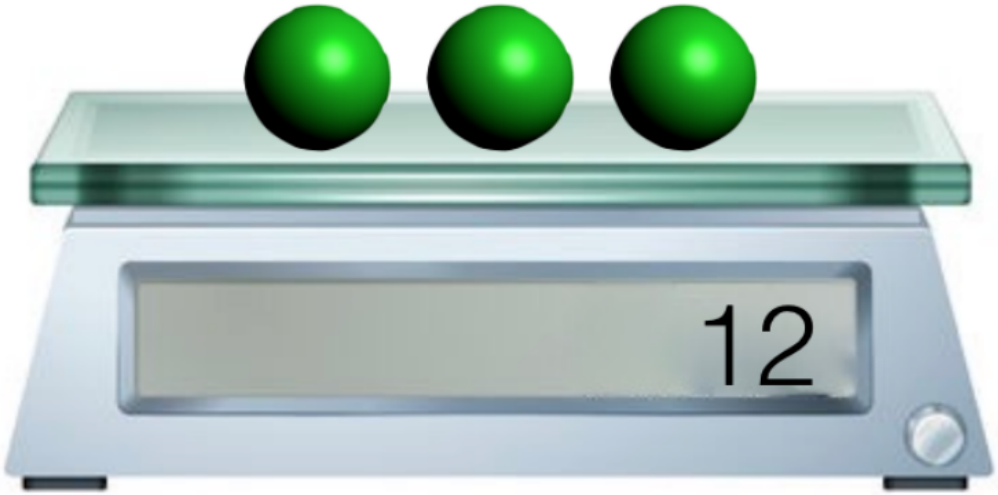
What do you notice?

What do you wonder?



What will balance 2 spheres?





How much does each shape weigh?

https://solveme.edc.org/Mobiles.html

Number Tricks

Words	Pictures	Lucy	Alex	Mila
Think of a number.		5	9	14
Double it.		10	18	28
Add 4.		14	22	32
Divide by 2. What did you get?		7	11	16

It's hard to undo... using JUST the words!

Math-ic Prediction

Words	Pictures	Diagrams	Hailee	Connor	Lura	Maury
Think of a number			7			
Double it				22		
Add 8					16	
Divide by 2						7

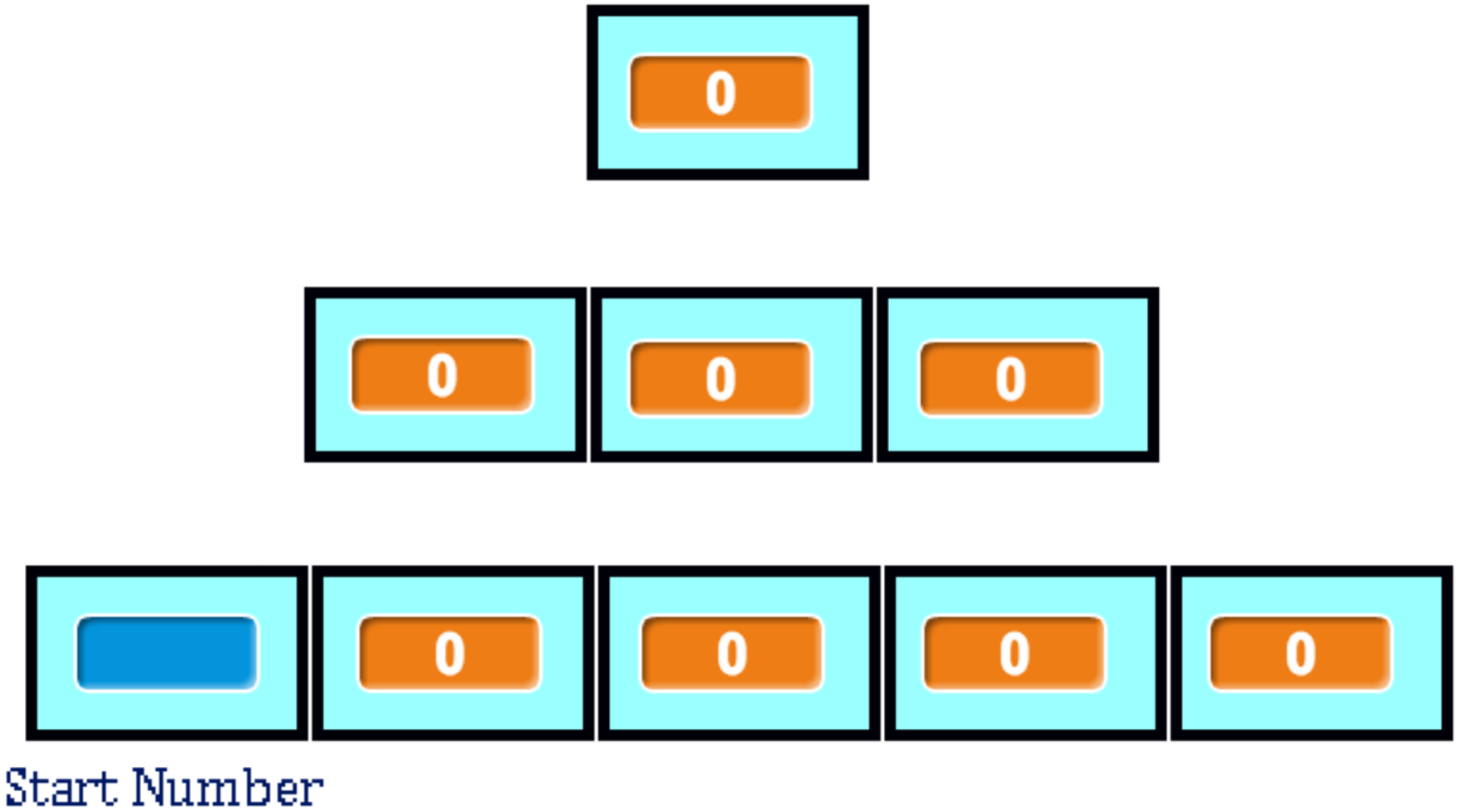
Consecutive Number Sums

Algebra
Magic Trick

Start Number

	7
	0
	0
	0
+	0
	0

Triangle Mystery



https://scratch.mit.edu/

3. The methods we use to compute and the structures in our number system can and should be generalized. For example, the generalization that $a + b = b + a$ tells us that $83 + 27 = 27 + 83$ without computing the sums on each side of the equal sign.

True or False Sentences

$120 = 60 \cdot 2$

$1 = \frac{3}{4} + \frac{2}{1}$

$318 = 318$

$\frac{1}{2} = \frac{1}{4} + \frac{1}{4}$

$347 + 71 = 70 + 348$

$1210 - 35 = 1310 - 45$

$0.4 \cdot 15 = 0.2 \cdot 30$

Open Sentences

$0.5 + \square = 5$ $\quad$ $0.4 + \square = 0.6$ $\quad$ $4.5 + 5.5 = \square - 1$

$0.3 \cdot 7 = 7 \cdot \square$ $\quad$ $\square \cdot 4 = 4.8$ $\quad$ $\square = 2.3 - 0.5$

Relational Thinking

True/False

Relational Thinking

True/False

$6.74 - 3.89 = 6.64 - 3.79$

$42 = 0.5 \cdot 84$

$\frac{2}{5} = \frac{1}{3} + \frac{1}{2}$

$64 \div 14 = 32 \div 28$

Open Sentences

$7.03 + 0.056 = 7.01 + \square$

$0.126 - 0.37 > \square -$

$$\frac{2}{5} = \frac{1}{3} + \frac{1}{2}$$

$$64 \div 14 = 32 \div 28$$

Open Sentences

$$7.03 + 0.056 = 7.01 + \square$$

$$0.126 - 0.37 > \square - 0.4$$

$$20 \cdot 4.8 = n \cdot 2.4$$

$$\frac{2}{5} + \frac{1}{5} = \frac{3}{10} + \frac{1}{10} + n$$

Name _____

The following statements are all INCORRECT.

1. Identify the mistake(s).
2. Correct.
3. Justify (show) your reasoning.

1. $2^5 = 10$

2. $(-2)^3 = 8$

3. $-6^2 = 36$

4. $37^0 = 0$

5. $100^{1/2} = 50$

6. $7^{-2} = -49$

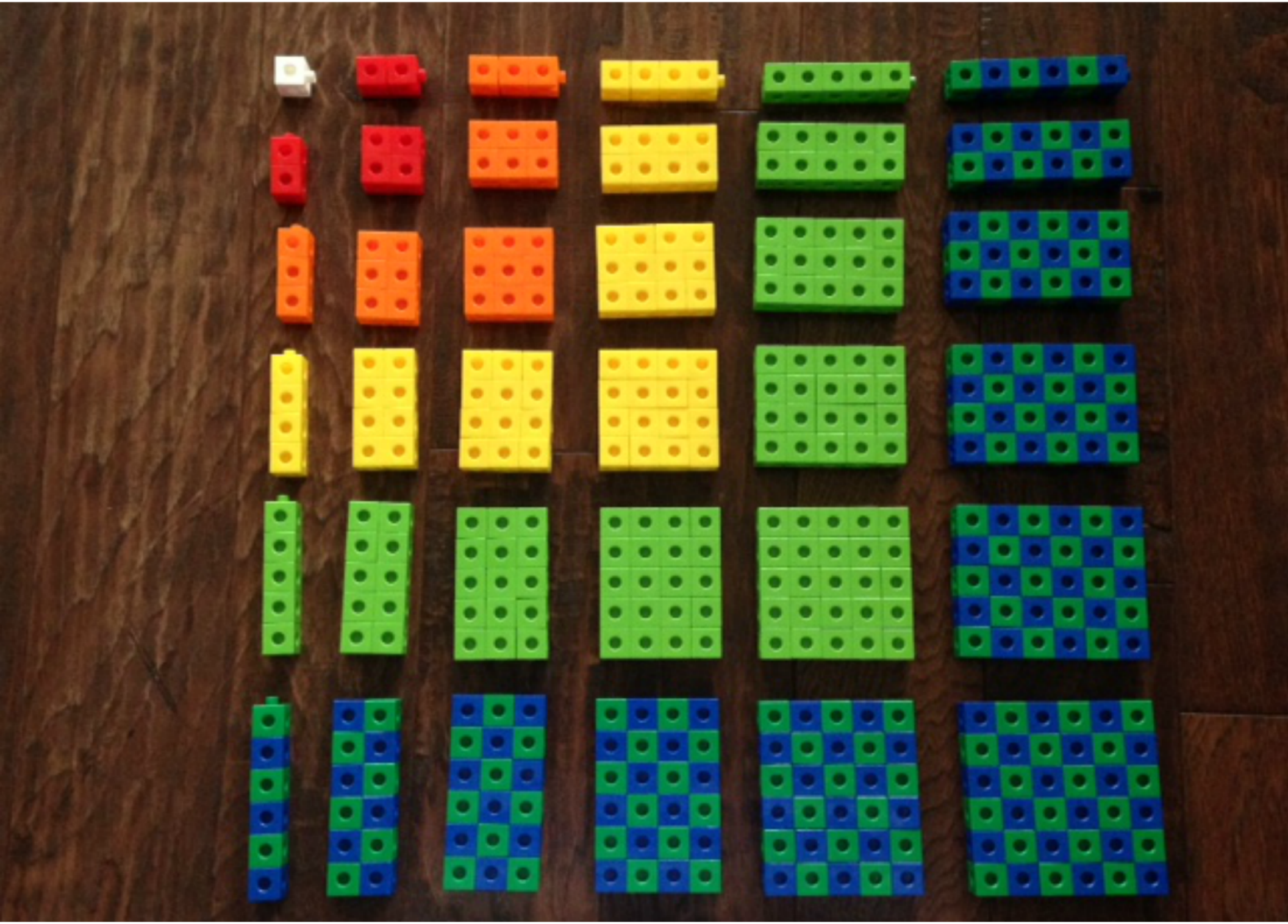
7. $(y^3)^5 = y^8$

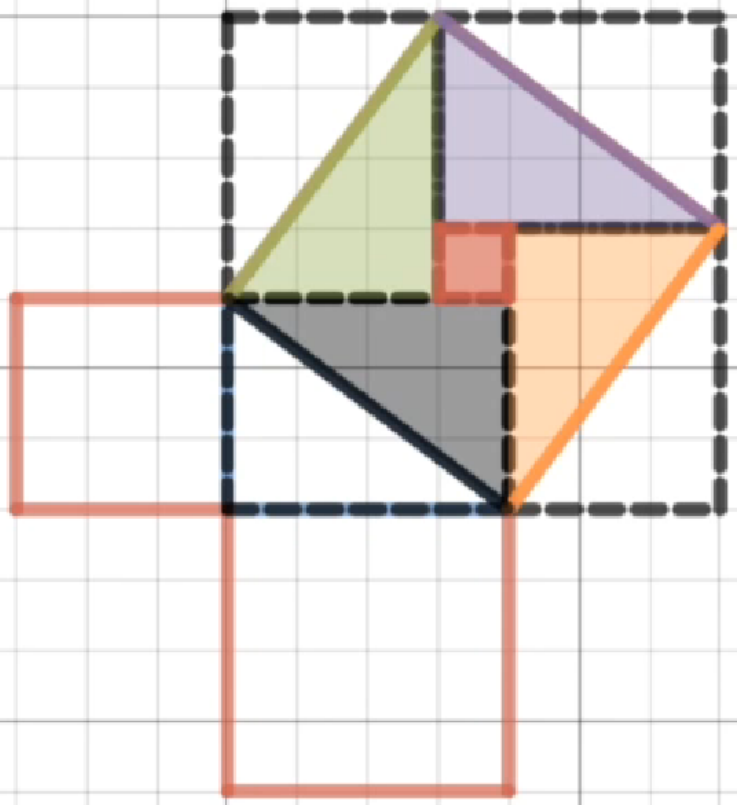
8 $\frac{x^5}{x^9} = x^4$

Sources: Andrew Stadel http://mr-stadel.blogspot.com/
Michael Pershan http://mathmistakes.org/

Andrew Stade

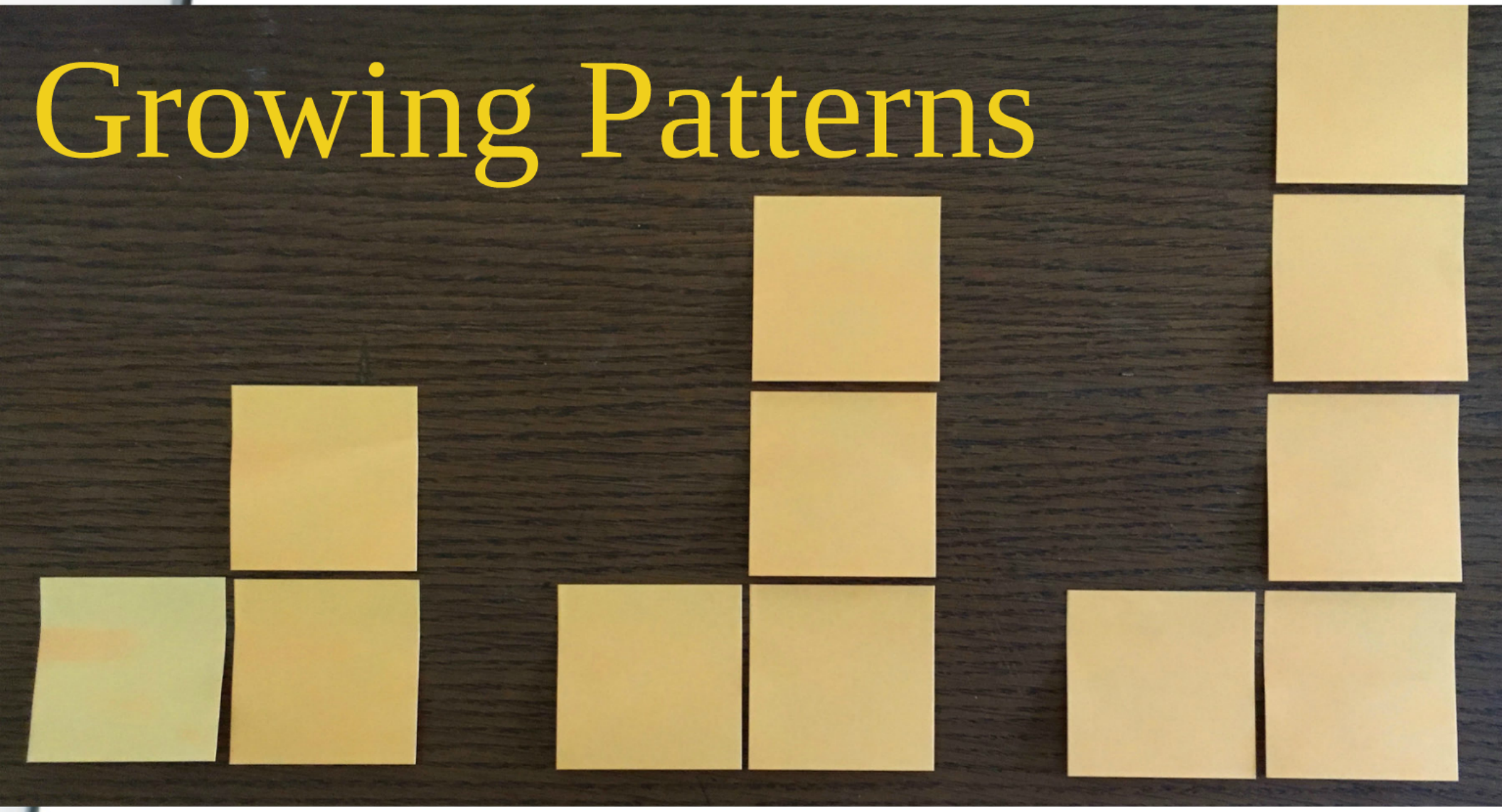
Michael Persha

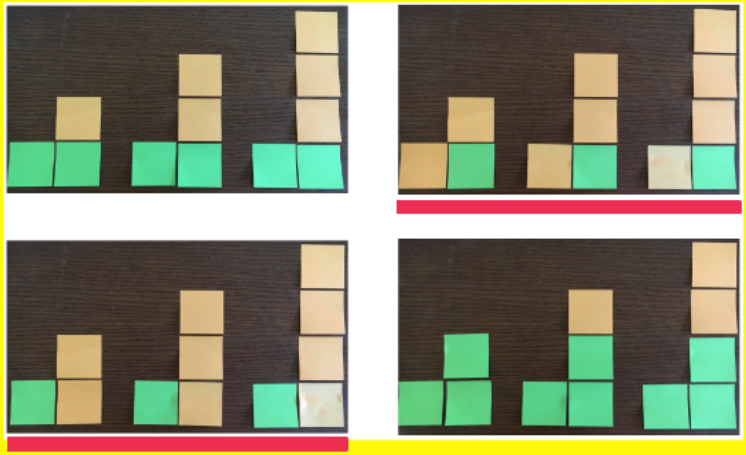




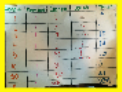
4. ***Patterns***, both repeating and growing, can be recognized, extended, and generalized.

Growing Patterns

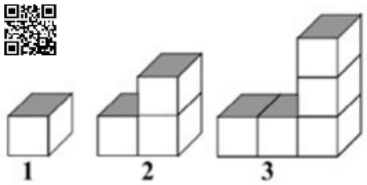


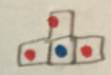
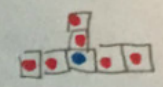
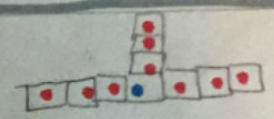
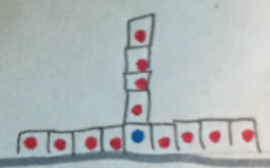
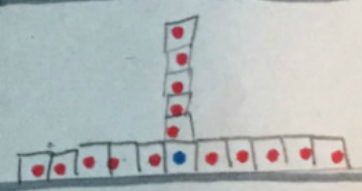


Step (Stage)	Sketch	Stays Same	Changes	Total (tiles in this case)
1	This column allows students to keep a record of their thinking. If they run out of time, they can pick up where they left off later without having to start from scratch.	1	2	3
2		1	3	4
3		1	4	5
4		1	5	6
5		1	6	7
13		1	14	15
37		1	38	39
n		1	n +1	n + 1 + 1

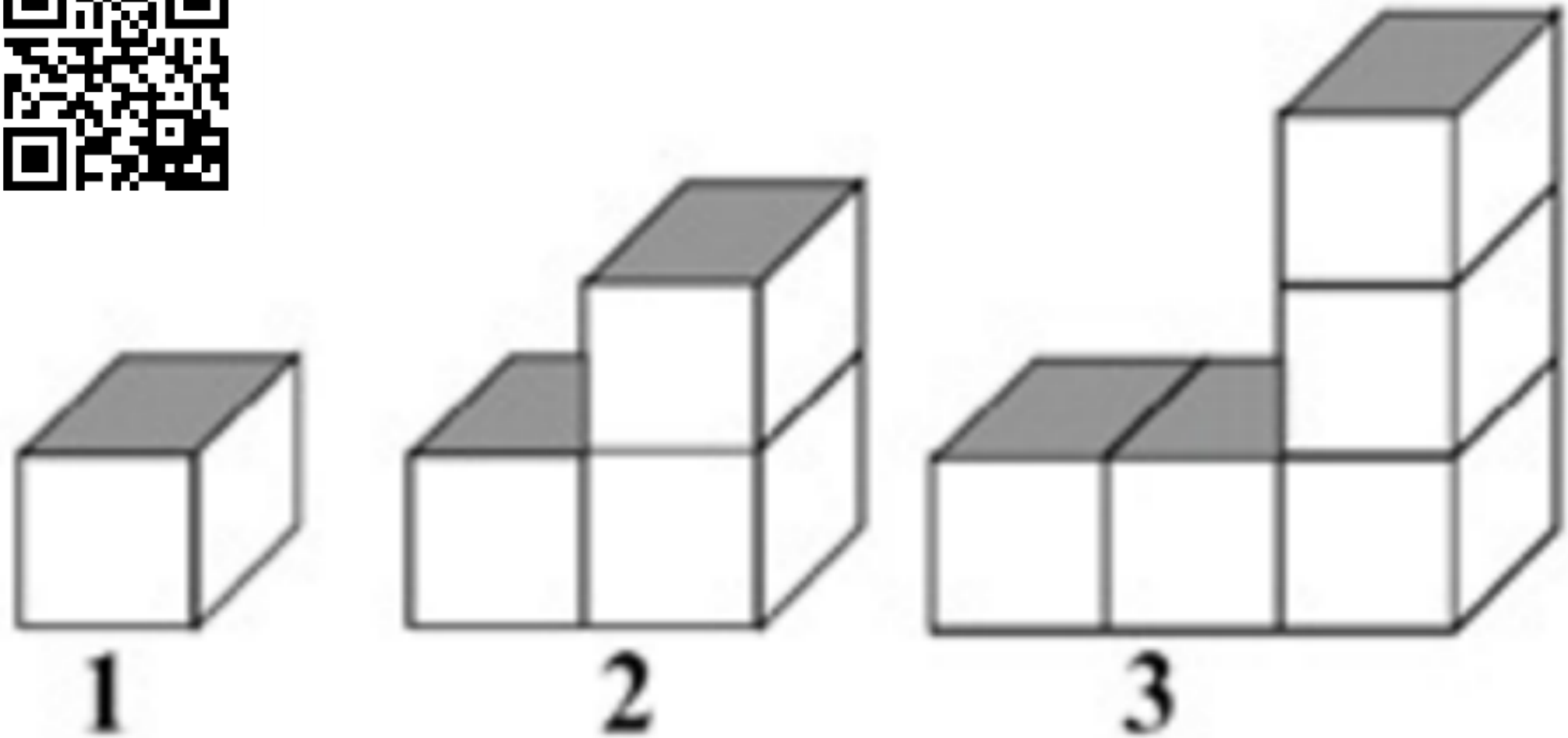


http://www.visualpatterns.org/



Stage #	Constant	Changes	Sketch	Total
1	1	3		4
2	1	6		7
3	1	9		10
4	1	12		13
5	1	15		16
10	1	30		31
50	1	150		151
n	1	nx3		nx3+1

http://www.visualpatterns.org/



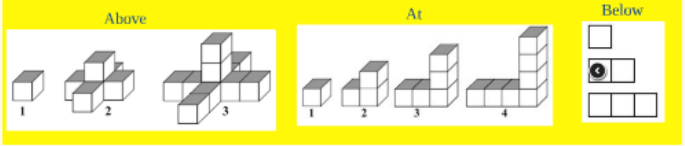
Meeting Students' Needs

Differentiation:

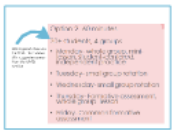
C-R-A at their own pace

Allow students their own time to build their understanding. They will be in different places of understanding which is normal. It is okay for students to remain in the representational stage for an extended period until they are ready to move to abstract thinking.

Tiered Tasks



Small Group Instruction



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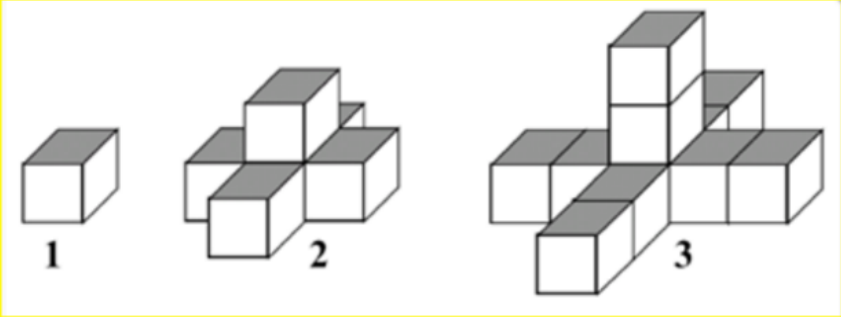
Tiered Tasks

Above



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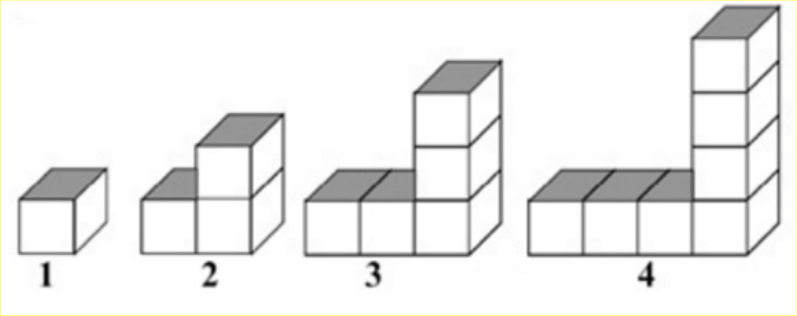

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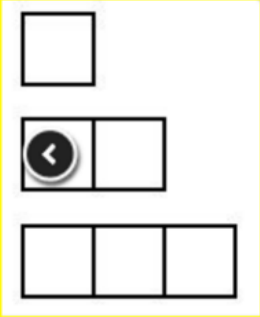
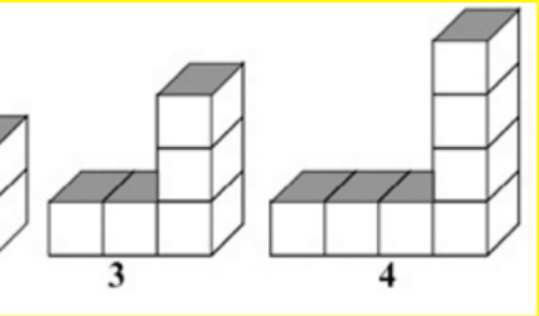


Small Gro

At



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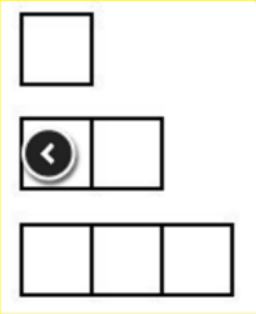
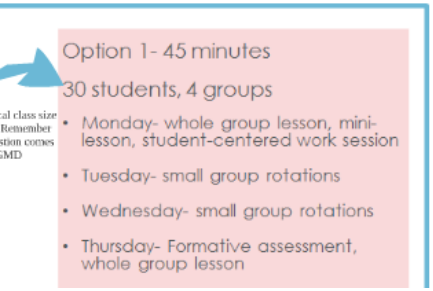
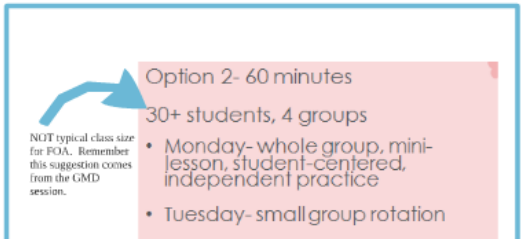


Small Group Instruction





NOT typical class size for FOA. Remember this suggestion comes from the GMD session.

Option 1- 45 minutes

30 students, 4 groups

- Monday- whole group lesson, mini-lesson, student-centered work session
- Tuesday- small group rotations
- Wednesday- small group rotations
- Thursday- Formative assessment, whole group lesson
- Friday- Common formative assessment

NOT typical class size for FOA. Remember this suggestion comes from the GMD session.

Option 2- 60 minutes

30+ students, 4 groups

- Monday- whole group, mini-lesson, student-centered, independent practice
- Tuesday- small group rotation
- Wednesday- small group rotation
- Thursday- Formative assessment, whole group lesson
- Friday- Common formative assessment

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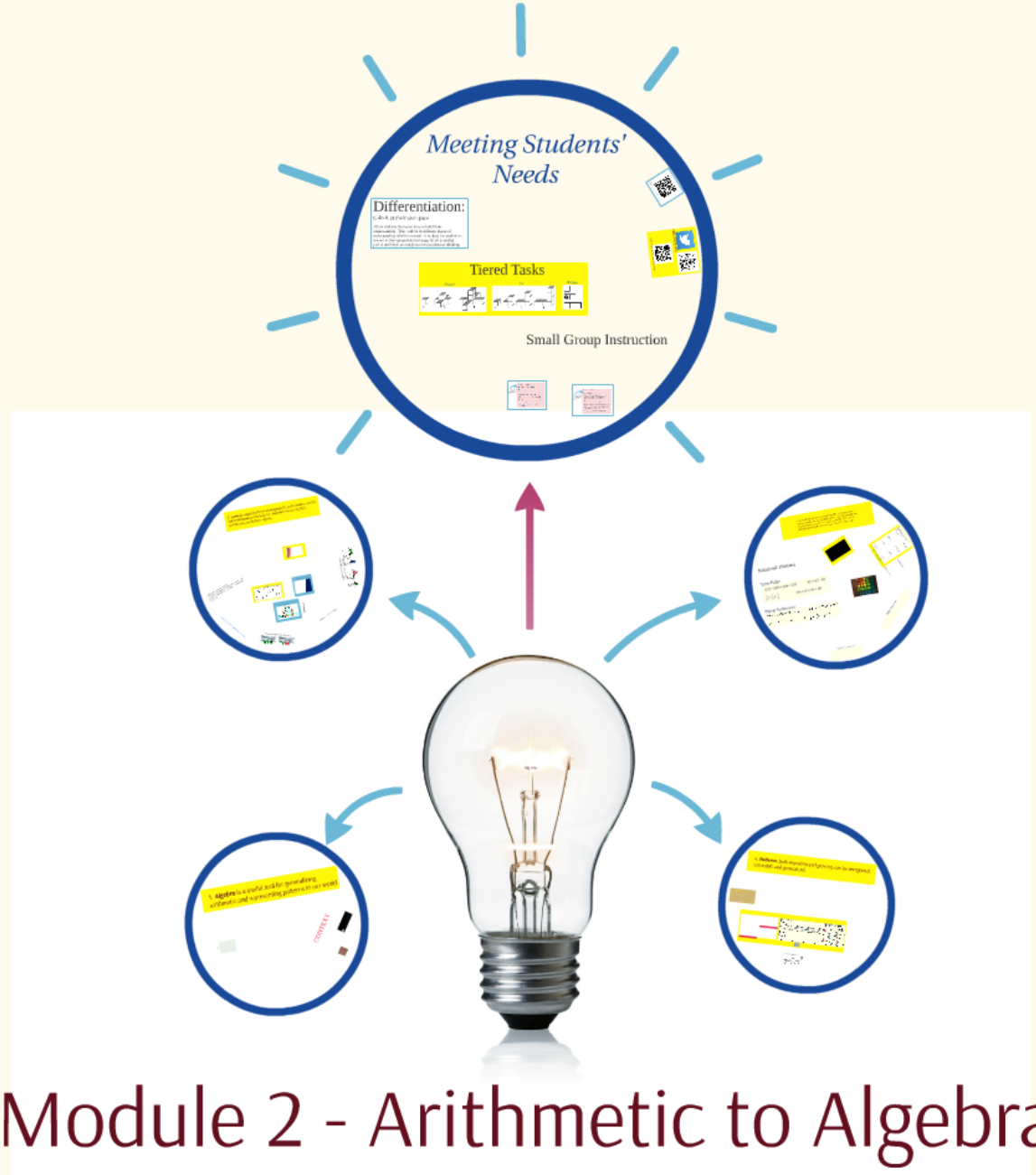
https://twitter.com/

https://exploremtbos.wordpress.com/



Module 2 - Arithmetic to Algebra