Get Your Model On

Mathematical Modeling in the Elementary Grades

by: **Graham Fletcher**
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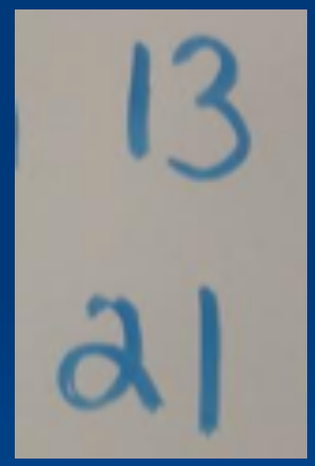
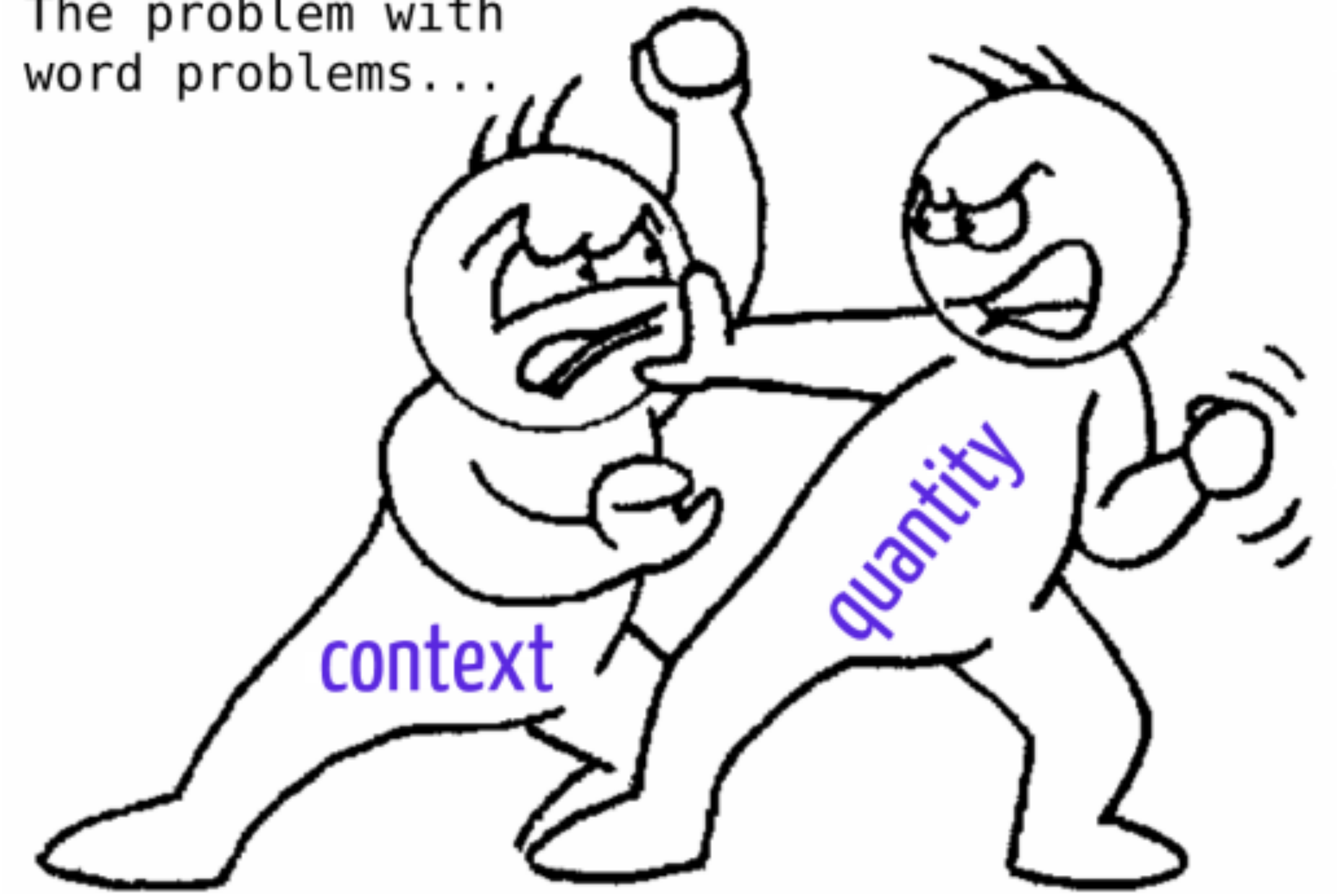
Joe had some playing cards in his bag. Ashley gave him 13 more cards. Joe now has 21 cards. How many cards did Joe have in his bag?


13
21

The problem with
word problems...



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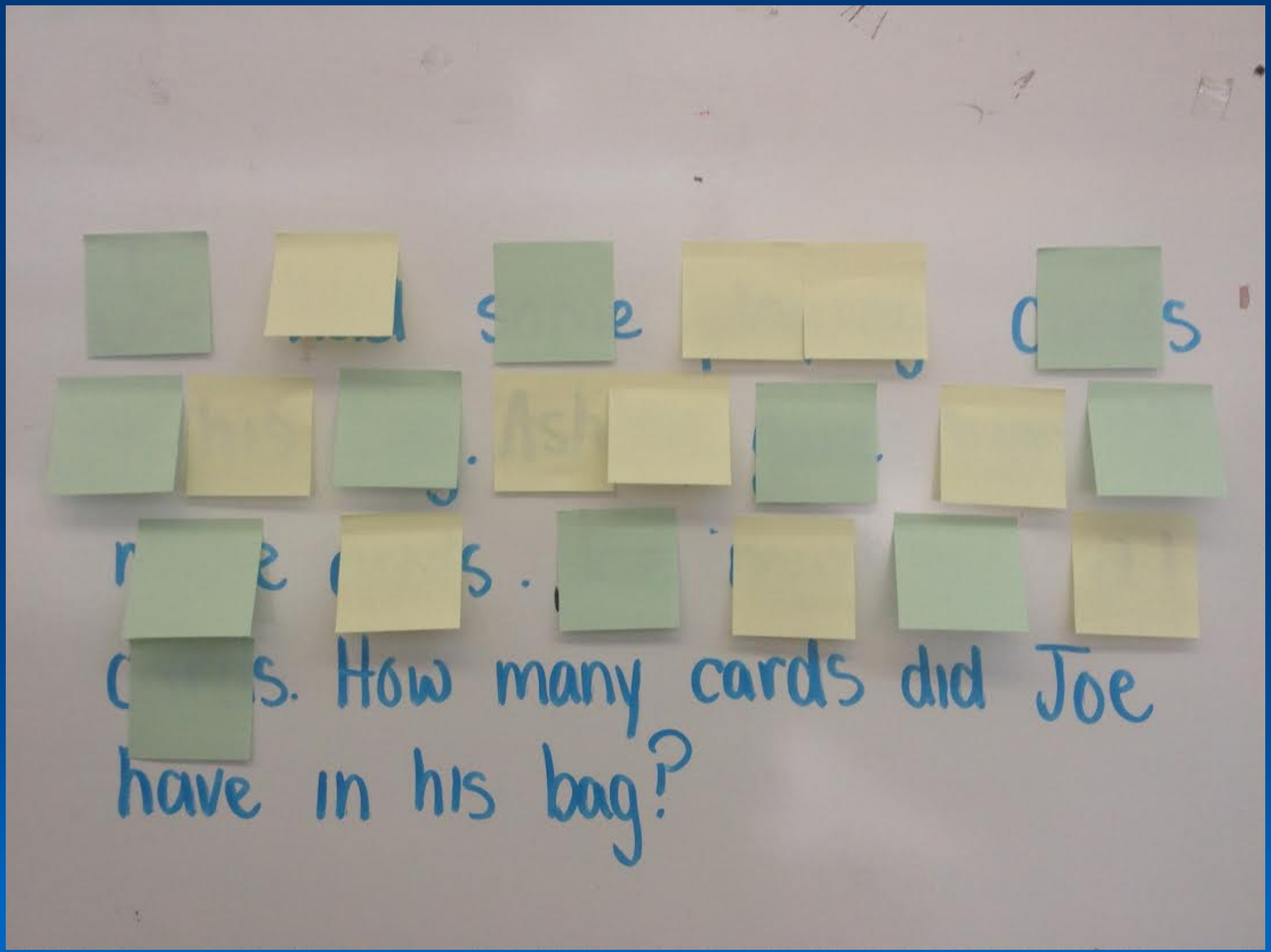
Joe had some playing cards in his bag. Ashley gave him [redacted] more cards. Joe now has [redacted] cards. How many cards did Joe have in his bag?


cards. How many cards did Joe
have in his bag?

3-ACT Tasks

What do you notice?

What do you wonder?

4. Estimate

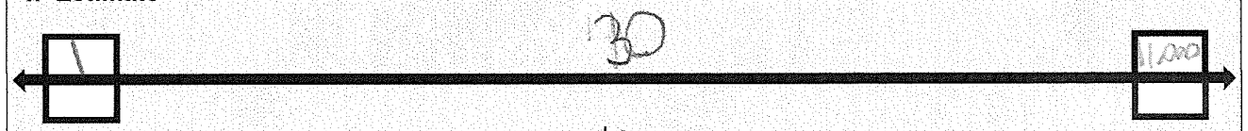
Name: [redacted] Date:

1. **What did you notice?** he put more and more wapers in the jar.

2. **What do you wonder?** how many wapers are in each pack?

3. **Main Question:** how many wapers are in the jar

4. **Estimate**



Low
High
Estimate
Estimate
place your best estimate on the number line and label

5. **What information would you like to know?** how many wapers are in each pack

?

Questions

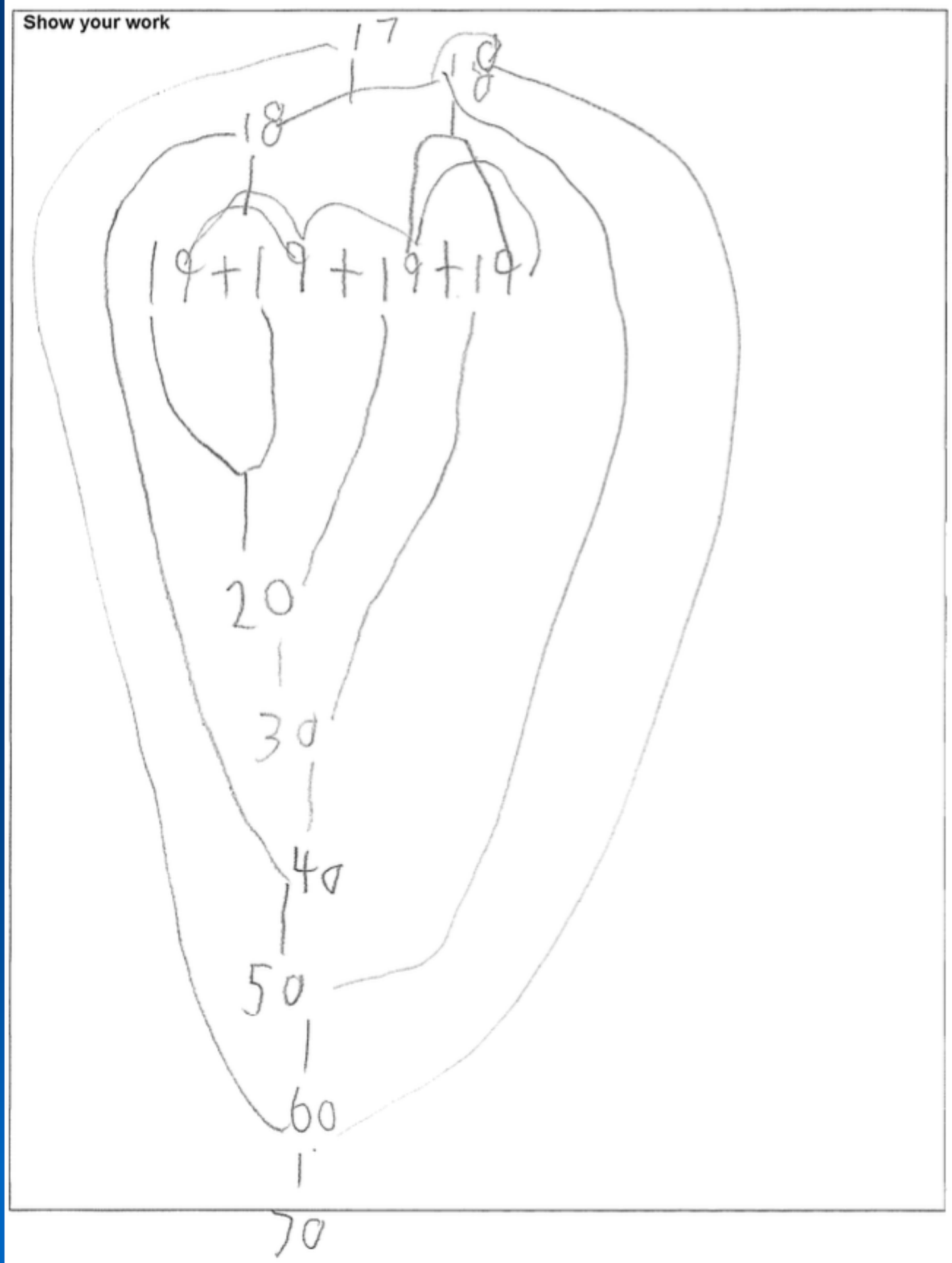
Packages Used

The number of Whoppers that come in a package

3 minutes

individual work time

Show your work



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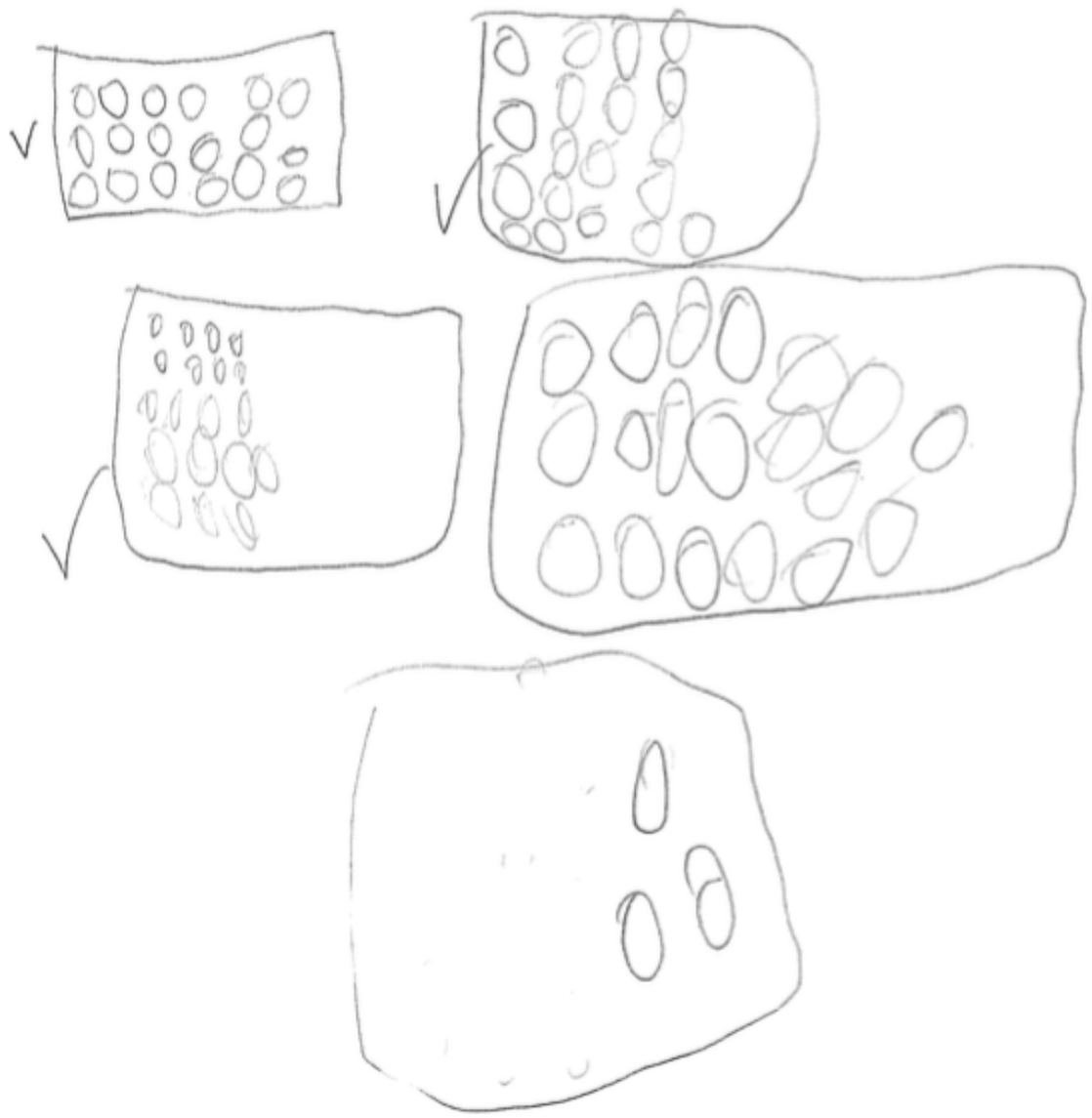
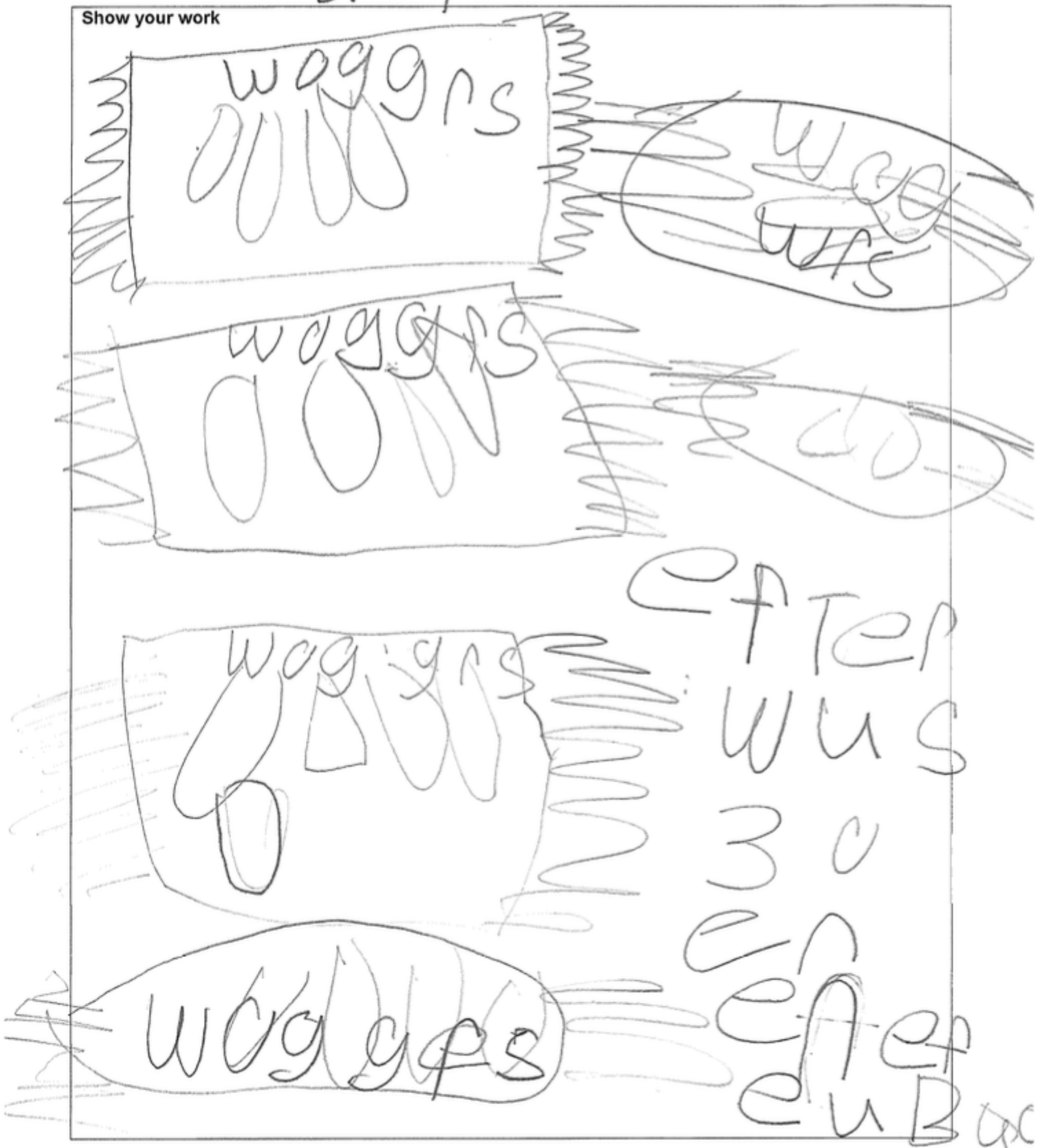
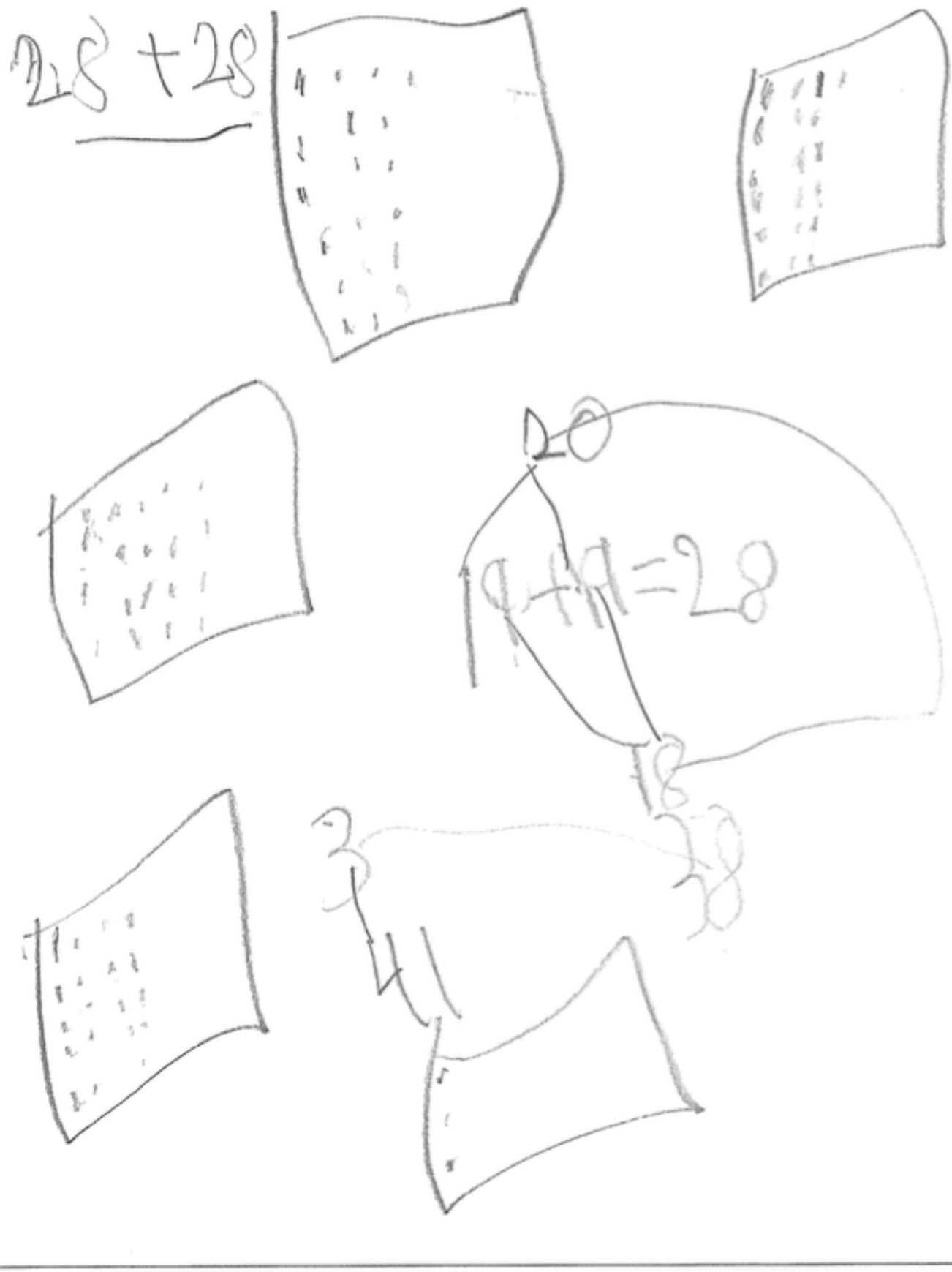


19+19=38+19=57+19=76+3=79

Show your work



Show your work

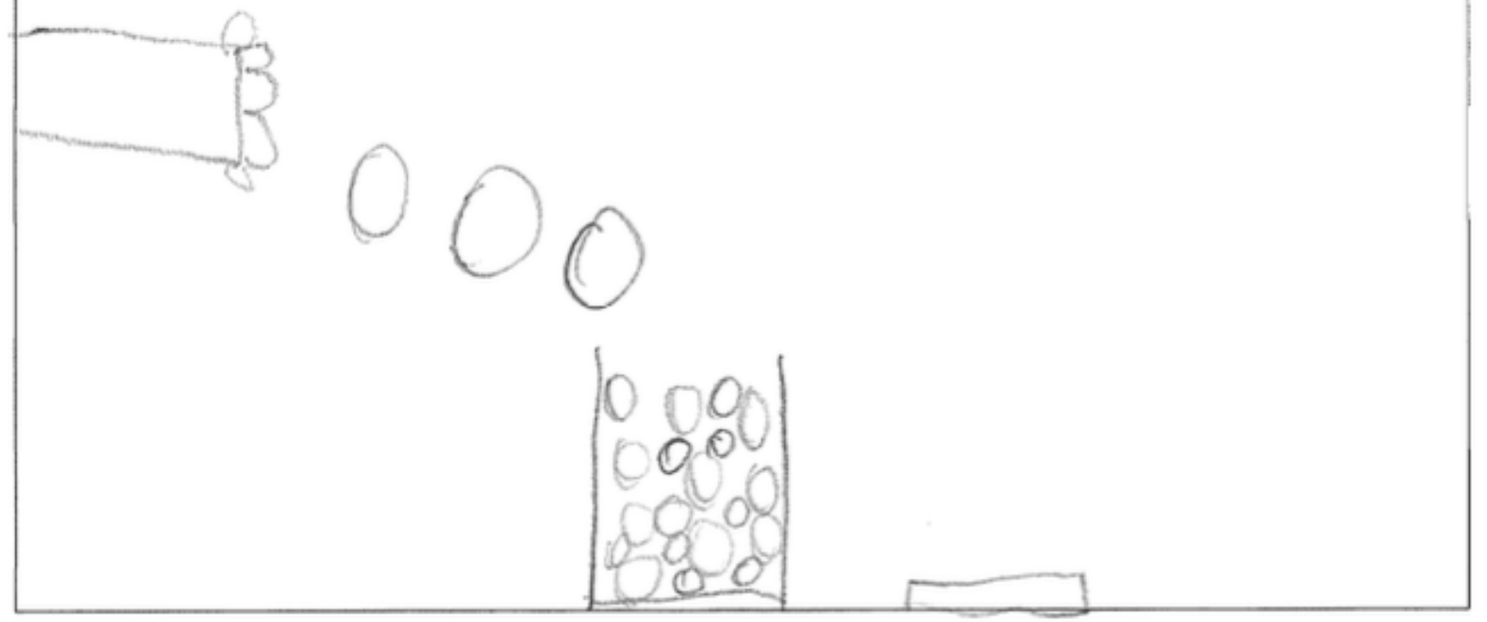


Show your work

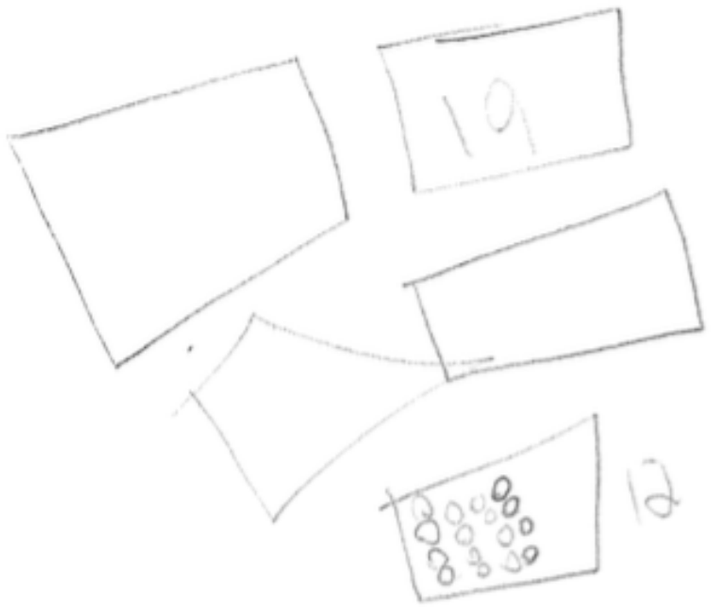
Noah

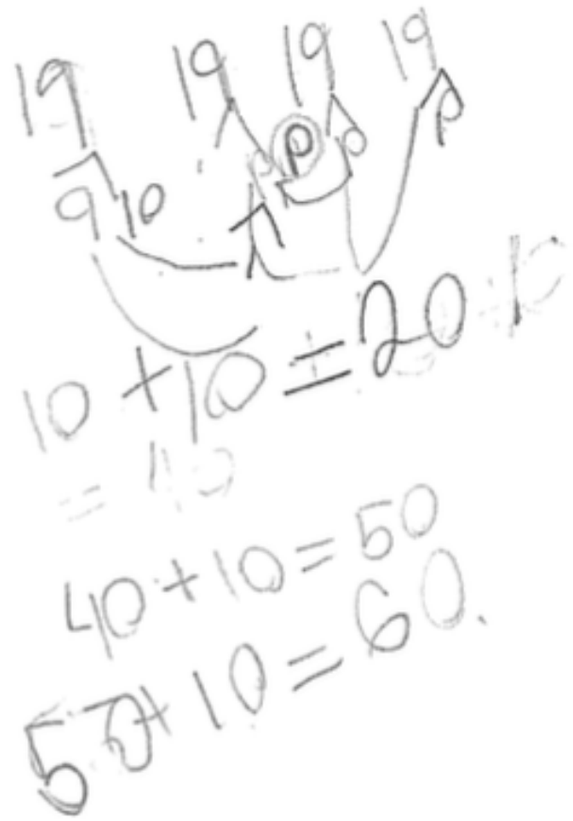
He put three whoppers in the jar thar was a litte spas.

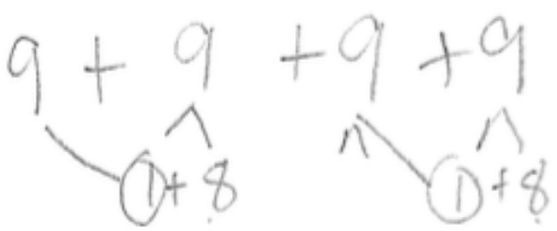
23



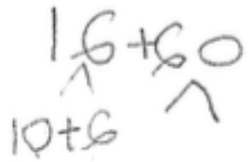
Show your work







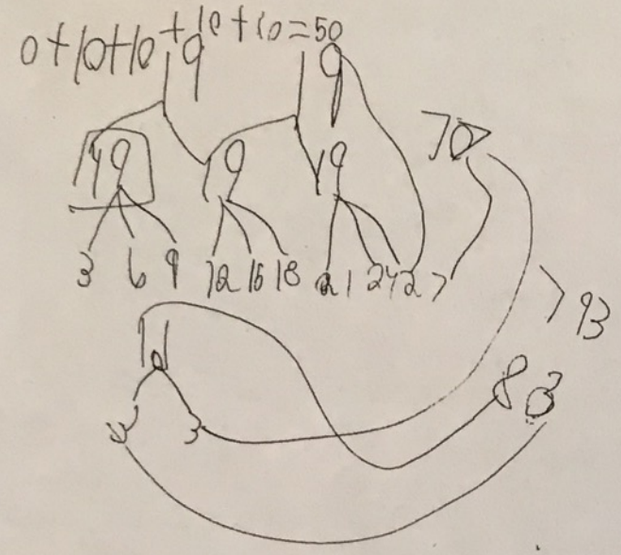
8 + 8 = 16

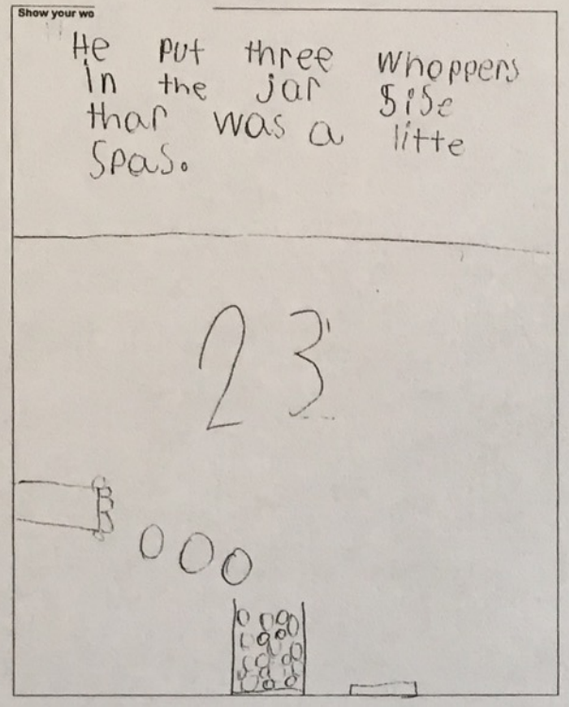


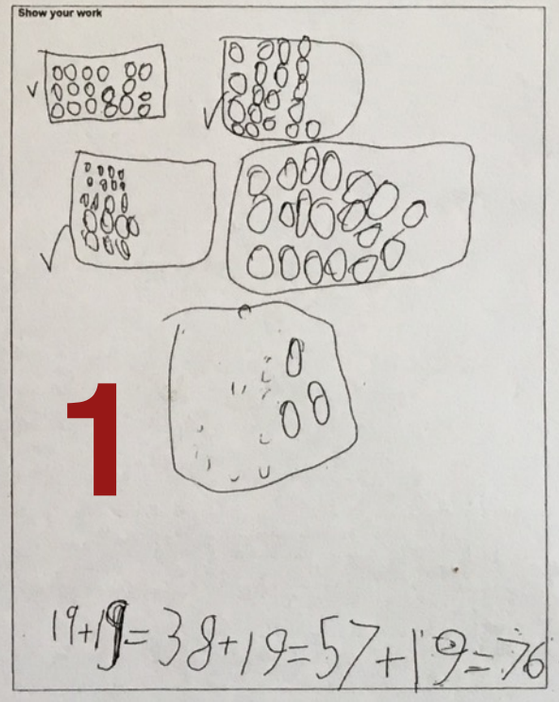
10 + 60 = 70
76 = 76
76 + 3 = 79

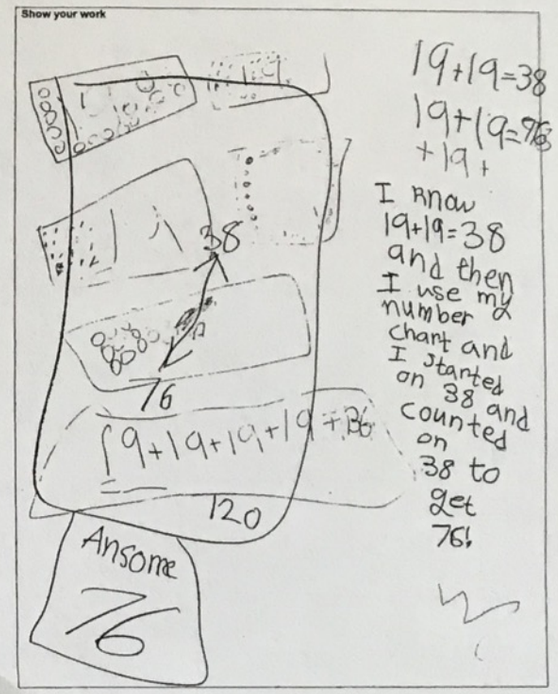
10 and 10 2p

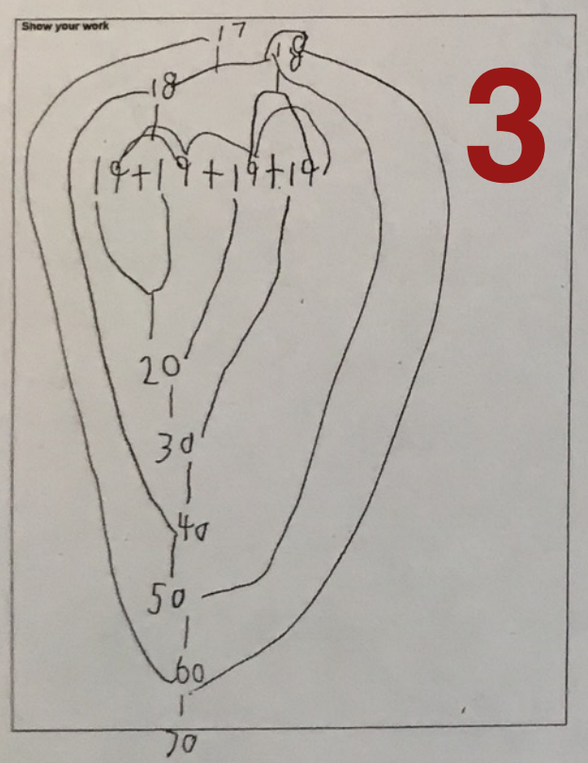
connecting the models

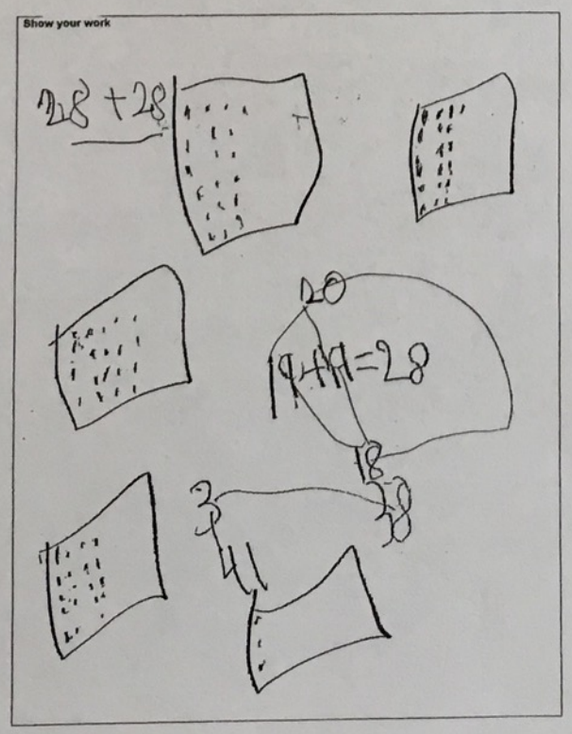


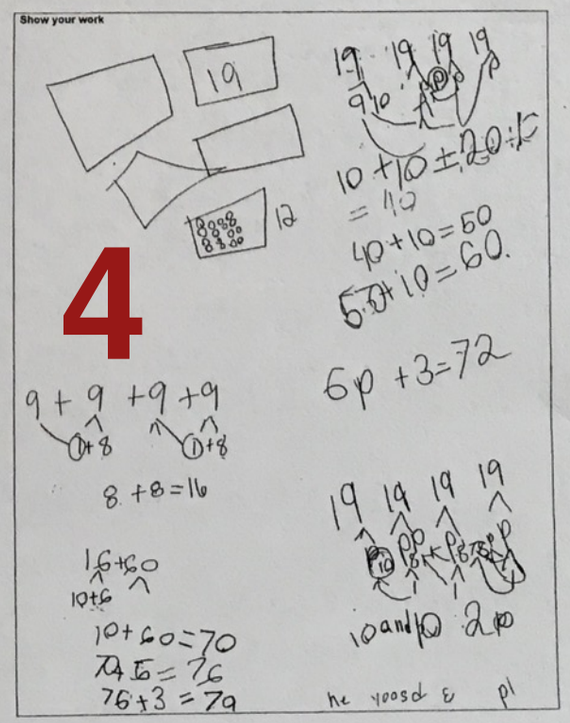


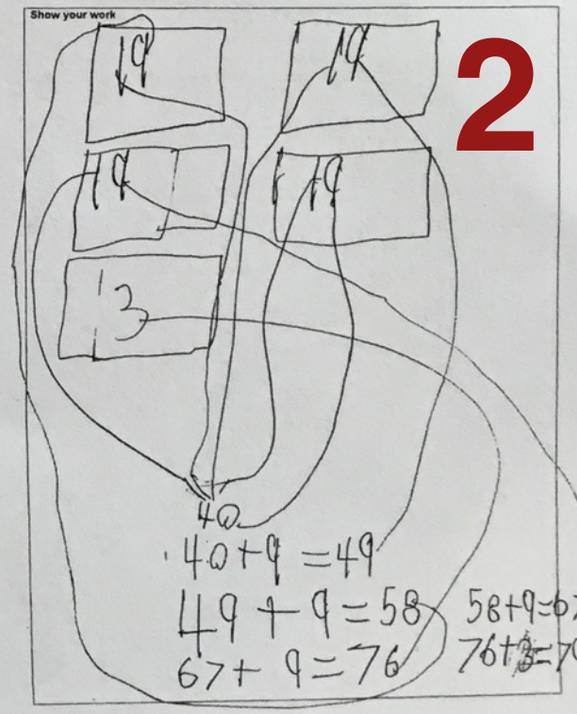












What **Standards for Mathematical Practice** did we just engage in?

Standards for Mathematical Practice

Mathematically Proficient Students can……

1. **Make sense of problems and persevere in solving them**
   - *-doing mathematics means solving problems and discussing how they solved them*
   - *-plan a solution pathway and adjust as needed as they work through the problem*
   - *-persevere (" First, I drew a diagram, and it didn't help, so I tried to make a table. That worked much better because I found a pattern.")*
   - *-explain thinking through equations, verbal descriptions, tables, graphs, diagrams and search for trends in data*
2. **Reason abstractly and quantitatively**
   - *-numbers represent quantities and these quantities can be represented with symbols*
   - *-generalize based on what they observe*
   - *-"I know that rectangles are parallelograms with four right angles ….so that means this square must be a rectangle because . . ."*
3. **Construct viable arguments and critique the reasoning of others**
   - *-make conjectures with support and reason through the use of objects, drawings, diagrams and actions*
   - *-ask and respond to questions like, "How did you get that?" and "Why is that true?"*
4. **Model with mathematics**
   - *-put mathematics in the context of real world situations and identify those relationships*
   - *-use organizational strategies such as making a table, creating a number line, drawing diagrams, use objects, etc.*
5. **Use appropriate tools strategically**
   - *-use familiar, grade appropriate tools and know when they can be helpful*
   - *-recognize both the strengths and limitations of the tool being used*

6. **Attend to precision**
   - *-communicate precisely to others through my language, models and representations*
   - *-calculate accurately and efficiently, and show flexibility with strategies*
7. **Look for and make use of structure**
   - *-look closely at patterns and structure*
   - *-identify and understand the make-up and inclusion of number (commutative and distributive properties)*
8. **Look for and express regularity in repeating reasoning**
   - *-continually evaluate the reasonableness of intermediate results ("I notice when I divide 4 by 11, I get 0.36, then I keep dividing the same numbers over and over.")*
   - *-students continually check their work by asking themselves, "Does this make sense?"*

What ISN”T mathematical modeling

- The use of manipulatives does not ensure that modeling with mathematics is taking place.
- If the mathematics is not contextualized, modeling with mathematics cannot exist.
- Modeling with mathematics does not mean, “I do, we do, you do.”

Model with Mathematics

Mathematically proficient students can apply the mathematics they know to **solve problems arising in everyday life**, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. Mathematically proficient students who can apply what they know are comfortable **making assumptions and approximations** to simplify a complicated situation, realizing that these may need revision later. They are able to **identify important quantities** in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can **analyze those relationships** mathematically to draw conclusions. They routinely **interpret their mathematical results** in the context of the situation and **reflect on whether the results make sense**, possibly improving the model if it has not served its purpose.

Model with Mathematics

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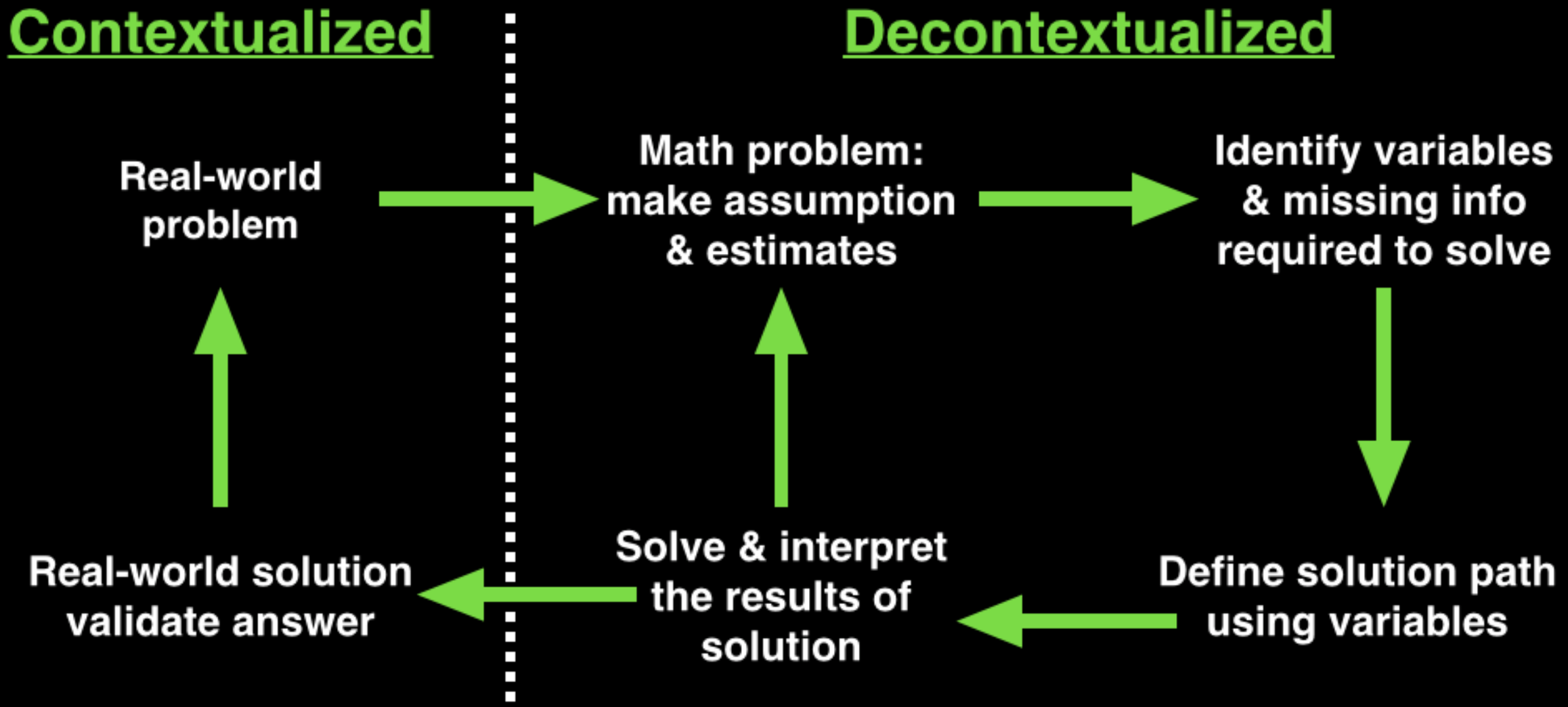
#4 Model with Mathematics in the Elementary Grades



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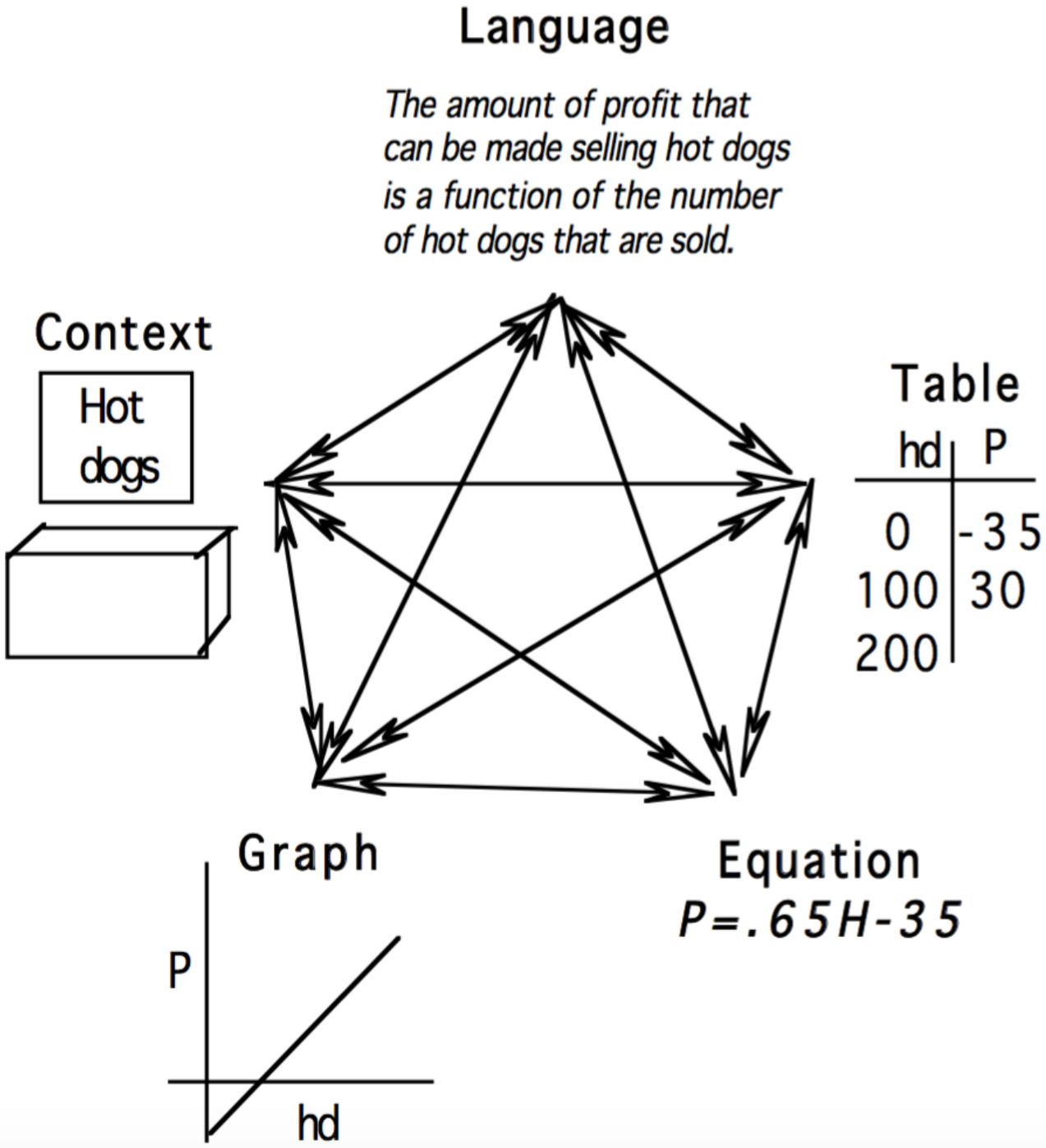
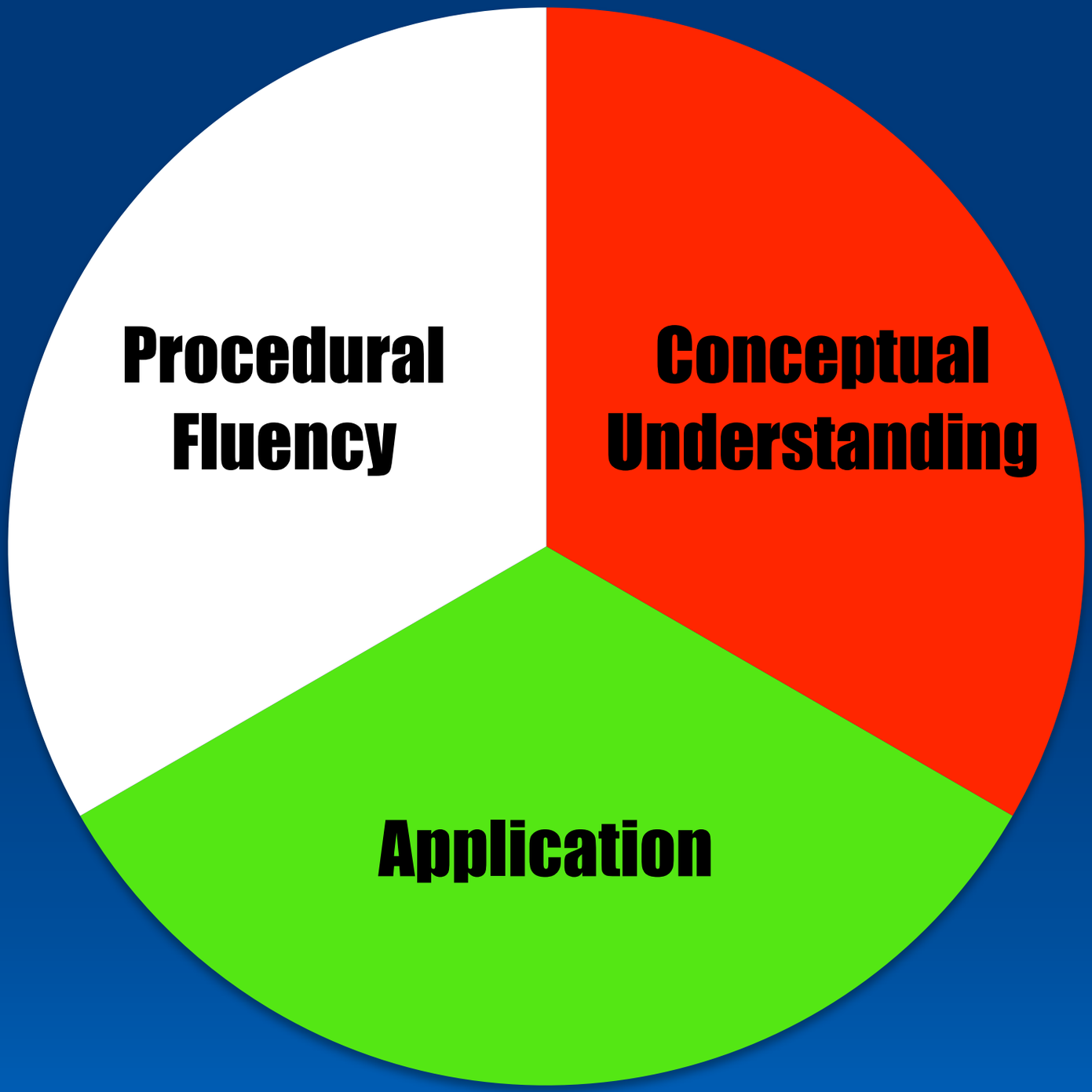
Five Representations of Functions



Most asked questions:

- How often should we use 3-Act Tasks?
- When should we use 3-Act tasks? How do they fit into the scope of a unit?
- How long does one task usually take?
- What if we don't have the time?
- Any others?

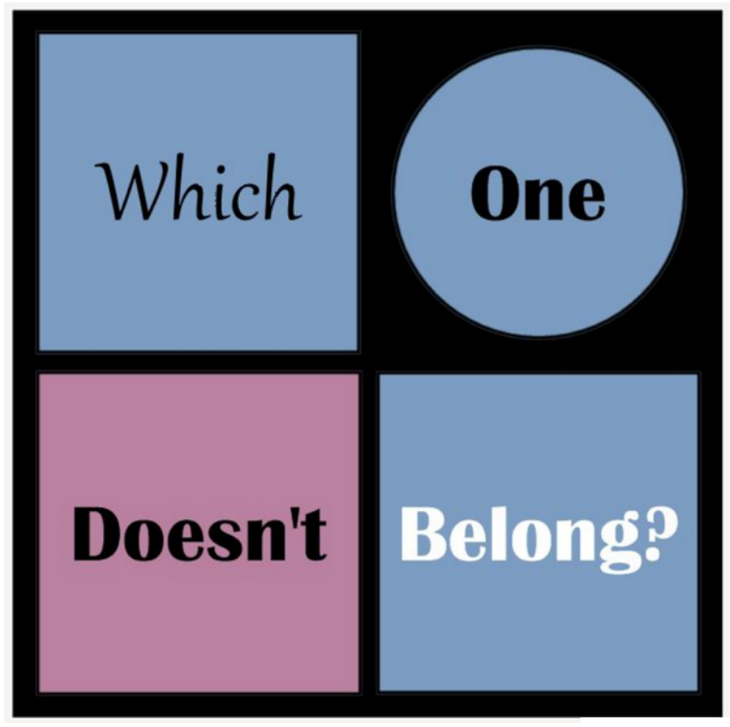

Procedural Fluency
Conceptual Understanding
Application

Tools that strengthen your modeling skills

ESTIMATION 180

Building number sense one day at a time.

Explore MTBoS



The Math Forum @ Drexel
PEOPLE LEARNING MATH TOGETHER

Notice and Wonder

Would You Rather?

ASKING STUDENTS TO CHOOSE THEIR OWN PATH AND JUSTIFY IT

What do you notice?

What do you wonder?

estimates?

need more?

Nutrition Facts/Datos de Nutrición

Serving Size 3 cookies (34g) / Porción: 3 galletas (34g)
Servings Per Container about 16
Porciones por Envase: Aproximadamente 16

Amount Per Serving/Cantidad por Porción

Calories/Calorías 160 — Calories from Fat/Calorías de Grasa 60

	%Daily Value*/%Valor Diario*
Total Fat/Grasa Total 7g	11%
Saturated Fat/Grasa Saturada 2g	10%
Trans Fat/Grasa Trans 0g	
Cholesterol/Colesterol 0mg	0%
Sodium/Sodio 135mg	6%
Potassium/Potasio 55mg	2%
Total Carbohydrate/Carbohidrato Total 25g	8%
Dietary Fiber/Fibra Dietética Less than/Menos de 1g	3%
Sugars/Azúcares 14g	
Protein/Proteínas 1g	

Vitamin/Vitamina A 0% • Vitamin/Vitamina C 0%
Calcium/Calcio 0% • Iron/Hierro 8%

*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be


7
5
10

3 Things on the road to modeling…

- Identify the problem, or pose a question.
- Make an estimate.
- Identify the variables needed to solve, and answer the problem or question posed.

Questioning My Metacognition

Trying to be a better teacher

3-Acts Lessons

Check out Dan's Blog or watch *Math Class Needs a Makeover*

Date Added	Lesson Title	Standard 1	Standard 2
4/17/2014	Peas in a Pod	K.NBT.1	K.CC.4
4/25/2014	Dotty	K.CC.1,2,3	K.CC.4,5
1/16/2015	Counting Squares	K.NBT.1	K.CC.4,5
1/16/2015	Stage 5 Series	K.NBT.1	K.CC.4,5
3/24/2015	Shark Bait	K.NBT.1	K.CC.4,5
3/4/2014	Lil' Sister	K.MD.2	K.CC.6
9/1/2015	Bag-O-Chips	K.OA.4	K.OA.5

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<u>Want more of the good stuff?</u>

Dan Meyer's 3-Act Tasks (6-12)

Robert Kaplinsky's Problem Based-Lessons (K-12)

Mike Wiernicki's 3-Act Tasks (K-8)

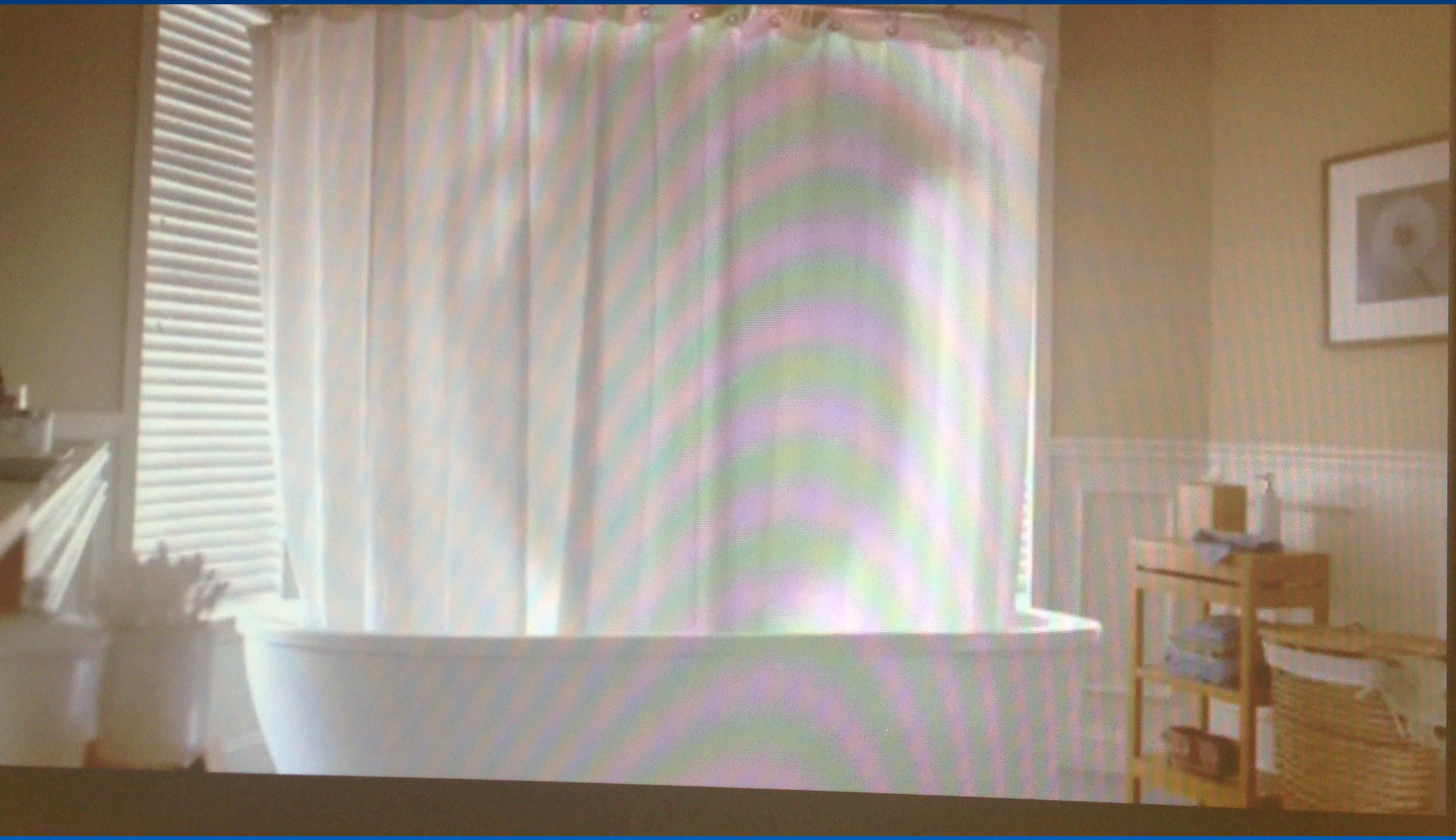
Andrew Stadel's Estimation 180 Lessons (6-12)

Dane Ehlert's 3-Act Tasks (3-12)

Kyle Pearce's 3-Act Tasks (3-12)

Geoff Krall (problem-based curriculum maps)

get plugged in



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