Meeting the Needs of Struggling Learners Prior to Algebra 1

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Turning the SHIP Around - The Riley Center - Meridian

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Mississippi Department of Education

VISION

To create a world-class educational system that gives students the knowledge and skills to be successful in college and the workforce, and to flourish as parents and citizens

MISSION

To provide leadership through the development of policy and accountability systems so that all students are prepared to compete in the global community

MISSISSIPPI DEPARTMENT OF EDUCATION
Ensuring a bright future for every child

State Board of Education Goals

FIVE-YEAR STRATEGIC PLAN FOR 2016-2020

1. All Students Proficient and Showing Growth in All Assessed Areas
2. Every Student Graduates From High School and is Ready for College and Career
3. Every Child Has Access to a High-Quality Early Childhood Program
4. Every School Has Effective Teachers and Leaders
5. Every Community Effectively Using a World-Class Data System to Improve Student Outcomes
6. Every School and District is Rated “C” or Higher

Supporting Students in Need of Intervention in the Mathematics Classroom

As an administrator your best support for mathematics teachers comes in the following forms/ways:

- observations (both critical and informal) with an established rubric for feedback and details
- lesson planning and “focus standard” studies
- asking tough questions about student learning
- pairing all teachers with a colleague
- examination of the work (assignments, tasks, homework, etc.)
- understanding of the K-12 mathematics content and expectations

Standards for Mathematical Practice

Directions:

On the next slide you will see the 8 Mathematical Practices listed. Without any aid or support, identify as a team what word(s) are hidden under each black box.

Standards for Mathematical Practice

1. Make [redacted] problems and [redacted] in solving them.
2. Reason [redacted] and [redacted].
3. Construct viable [redacted] and critique the reasoning of others.
4. [redacted] with mathematics.
5. Use appropriate [redacted] strategically.
6. Attend to [redacted]
7. Look for and [redacted] of structure.
8. Look for and [redacted] in repeated reasoning.

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Standards for Mathematical Practice

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Standards for Mathematical Practice – The Road to Intervention Supports

Directions:

Reflect on the mathematical instruction that took place in your school(s) this past year. Provide a letter-grade, A-F, for implementation of each MP.

BE BOLD! BE HONEST!

MP 1	MP 2	MP 3	MP 4
MP 5	MP 6	MP 7	MP 8

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REPORT OUT

Intervention Supports for All Students

- **Rigorous**
  - If the item is not rigorous enough, rewrite it with the language and intent of the Standards
- **Open-ended, constructed response**
  - Less multiple choice and fill in the blank
- **Mathematical Practices**
  - Provide opportunities for students to "showcase" as many MPs as possible on a given task

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Intervention Supports for All Students

- Should be intentional
- Require planning
- Depend on the focus standard
- Should not isolate, pinpoint, or identify/single-out students OR their misconceptions (safe environment pending)
- All students should get the same assignment, with modifications as possible

Taking a Look at a Middle Grades Focus Standards

6.EE.1	Write and evaluate numerical expressions involving whole-number exponents.
6.EE.2	Write, read, and evaluate expressions in which letters stand for numbers. a. Write expressions that record operations with numbers and with letters standing for numbers. *For example, express the calculation "Subtract y from 5" as 5 – y.* b. Identify parts of an expression using mathematical terms (sum, term, product, factor, quotient, coefficient); view one or more parts of an expression as a single entity. *For example, describe the expression 2 (8 + 7) as a product of two factors; view (8 + 7) as both a single entity and a sum of two terms.* c. Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations). *For example, use the formulas $V = s^3$ and $A = 6\ s^2$ to find the volume and surface area of a cube with sides of length $s = 1/2$.*

8.EE.1	Know and apply the properties of integer exponents to generate equivalent numerical expressions. *For example,* $3^2 \times 3^{-5} = 3^{-3} = 1/3^3 = 1/27$.

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Where Might These Standards Be Going?

F-BF.1	Write a function that describes a relationship between two quantities.* a. Determine an explicit expression or steps for calculation from a context.

A-CED.1	Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions.**
A-CED.2	Create equations in two variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.* *[Note this standard appears in future courses with a slight variation in the standard language.]*
A-CED.3	Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.**
A-CED.4	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law V = IR to highlight resistance R.**

Intervention Activity – Whole Class

Directions:

1. You will work in pairs to complete this activity.
2. Locate the white basket in the center of your table.
3. Remove the colored pencils and sheets of paper (yellow and white).
4. Be prepared to report out and post your work.

REPORT OUT

Please Note:
The answer key will be shared during this presentation, but is removed from the printed materials to ensure participants are able to engage in the activity without looking at the answers ☺

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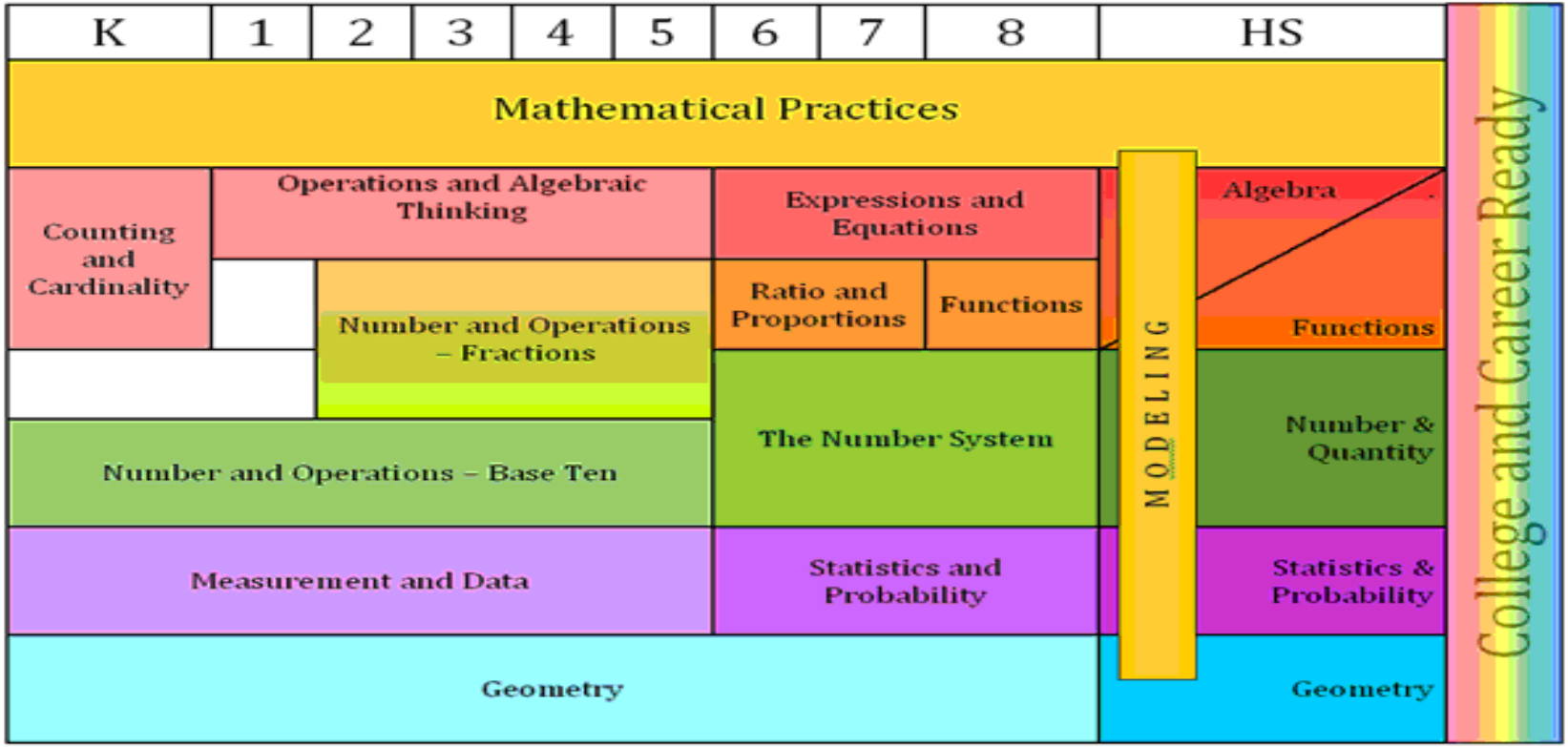
Intervention Activity – Whole Class

Directions:

Fill in the blank for each item below based on this activity.

- Students are protected by _____.
- The teacher is able to _____.
- Working in pairs allowed _____.
- Each item in the activity was _____.
- Activities like this _____.
- Evidence of the SMPs are evident when/in _____.

This Activity & The MS CCRS for Mathematics Sequence



Before we get started

- If you have a laptop/Chromebook, please go **AlgebraNation.com**
- If you have an iPad/mobile device, please download the app:

Username: msdemo **Password**: algebra

(Note: Laptop/Chromebook preferred to access all teacher/admin tools)

K - 5

↓

6 - 8

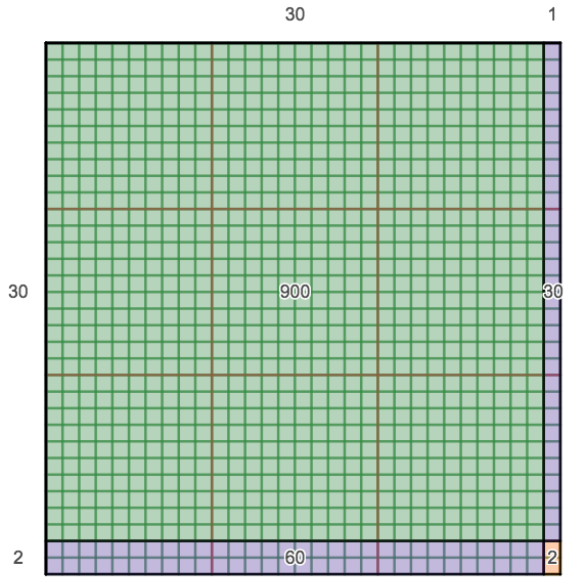
↓

Algebra 1

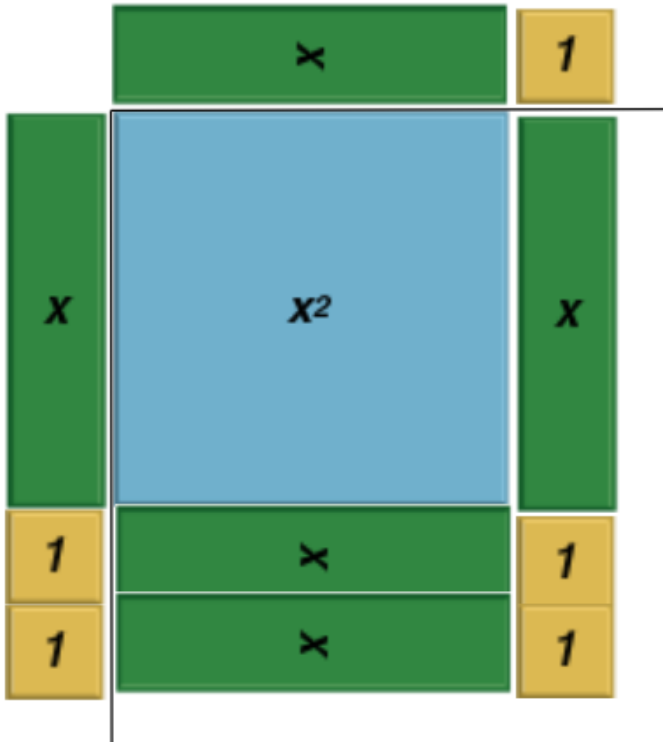
Example: Multiplication

31 x 32

(30+1) x (30 + 2)



(x + 1)(x + 2)



Example: Long Division

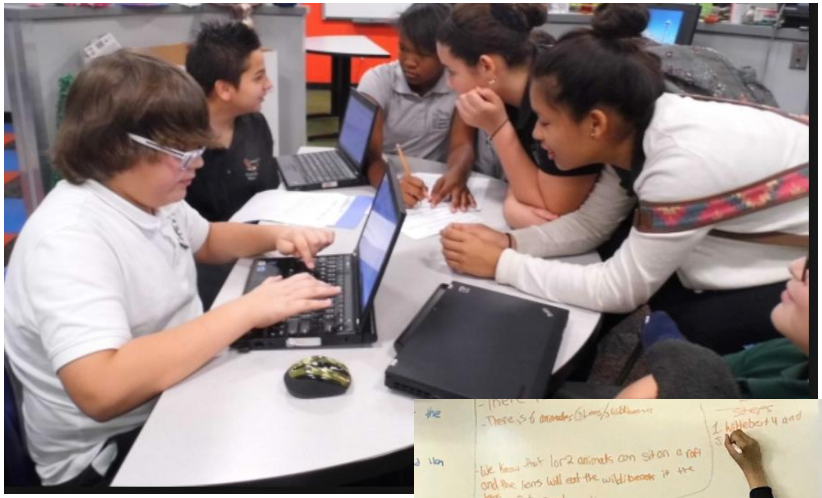
$$
\begin{array}{r}
2 \\
7\overline{)\,15} \\
-14 \\
\hline
1
\end{array}
\quad \leftarrow \text{remainder}
$$

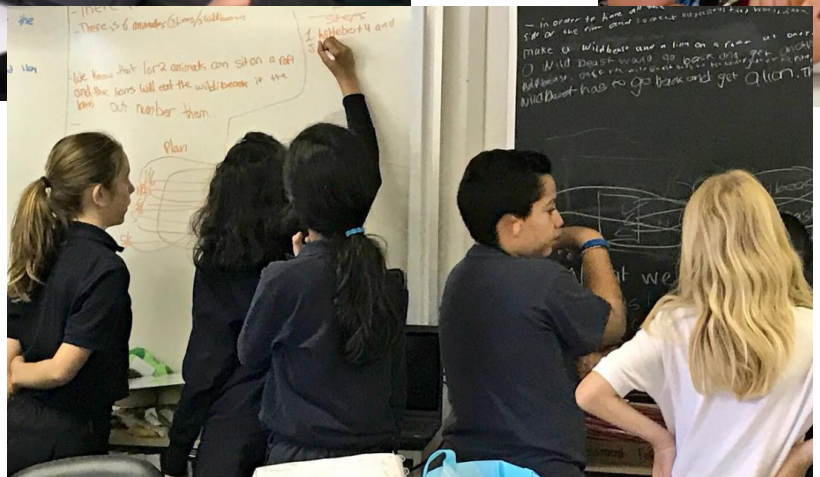
$$
\begin{array}{r}
7x^3 + x^2 - 5x - 8 \\
2x-1\overline{)\,14x^4 - 5x^3 - 11x^2 - 11x + 8} \\
-(14x^4 - 7x^3) \\
\hline
2x^3 - 11x^2 \\
-(2x^3 - x^2) \\
\hline
-10x^2 - 11x \\
-(-10x^2 + 5x) \\
\hline
-16x + 8 \\
-(-16x + 8) \\
\hline
0
\end{array}
$$

Shifts in “Traditional” Mathematical Instruction

https://images.app.goo.gl/fiY5qrEWTid1HW96A https://images.app.goo.gl/Q3Y8WudP74n1GbfP8

What The “Math Classroom” Might Look Like Today





https://images.app.goo.gl/oTYkSSP9gn3FNSyH6
https://images.app.goo.gl/Rxh6UtoXtLb24E178
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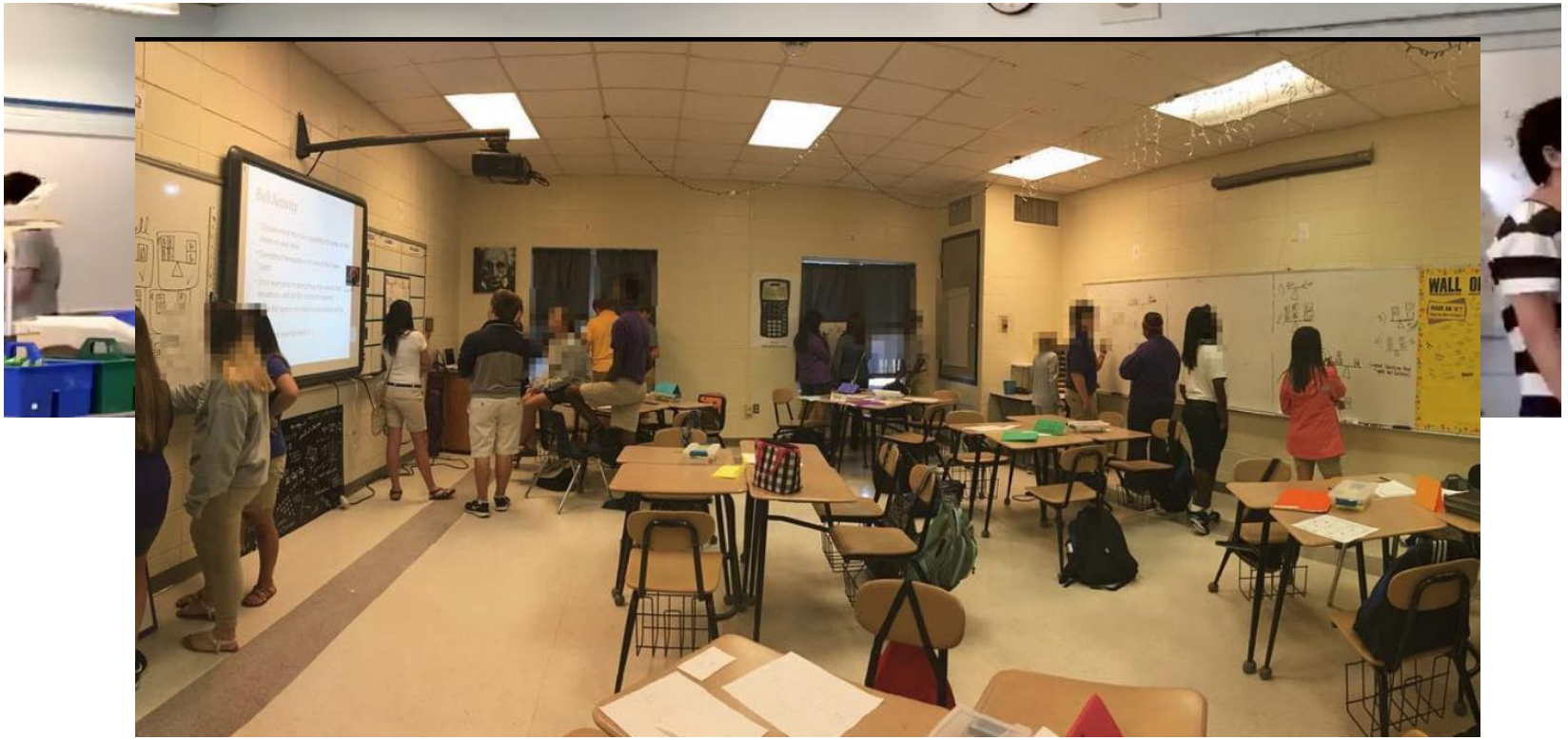
“Thinking Classrooms”



Thinking Classroom

	vertical non-perm	horizontal non-perm	vertical permanent	horizontal permanent	notebook
N (groups)	10	10	9	9	8
time to task	12.8 sec	13.2 sec	12.1 sec	14.1 sec	13.0 sec
first notation	20.3 sec	23.5 sec	2.4 min	2.1 min	18.2 sec
discussion	2.8	2.2	1.5	1.1	0.6
eagerness	3.0	2.3	1.2	1.0	0.9
participation	2.8	2.3	1.8	1.6	0.9
persistence	2.6	2.6	1.8	1.9	1.9
mobility	2.5	1.2	2.0	1.3	1.2
non-linearity	2.7	2.9	1.0	1.1	0.8

Effect Sizes for Instructional Variables

Special Education

- Student Think-Alouds (0.98)

Struggling Students

- Use of structured peer-assisted learning activities involving heterogenous ability grouping (0.62)

Gersten, R. and Clark, B. (2007). Effective Strategies for Teaching Students with Difficulty in Mathematics. Research Brief, *National Council of Teachers of Mathematics*.

4 Rights of the Learner in the Math Classroom

1. The right to be confused;
2. The right to claim a mistake;
3. The right to speak, listen, and be heard;
4. The right to write, do, and represent only what makes sense.

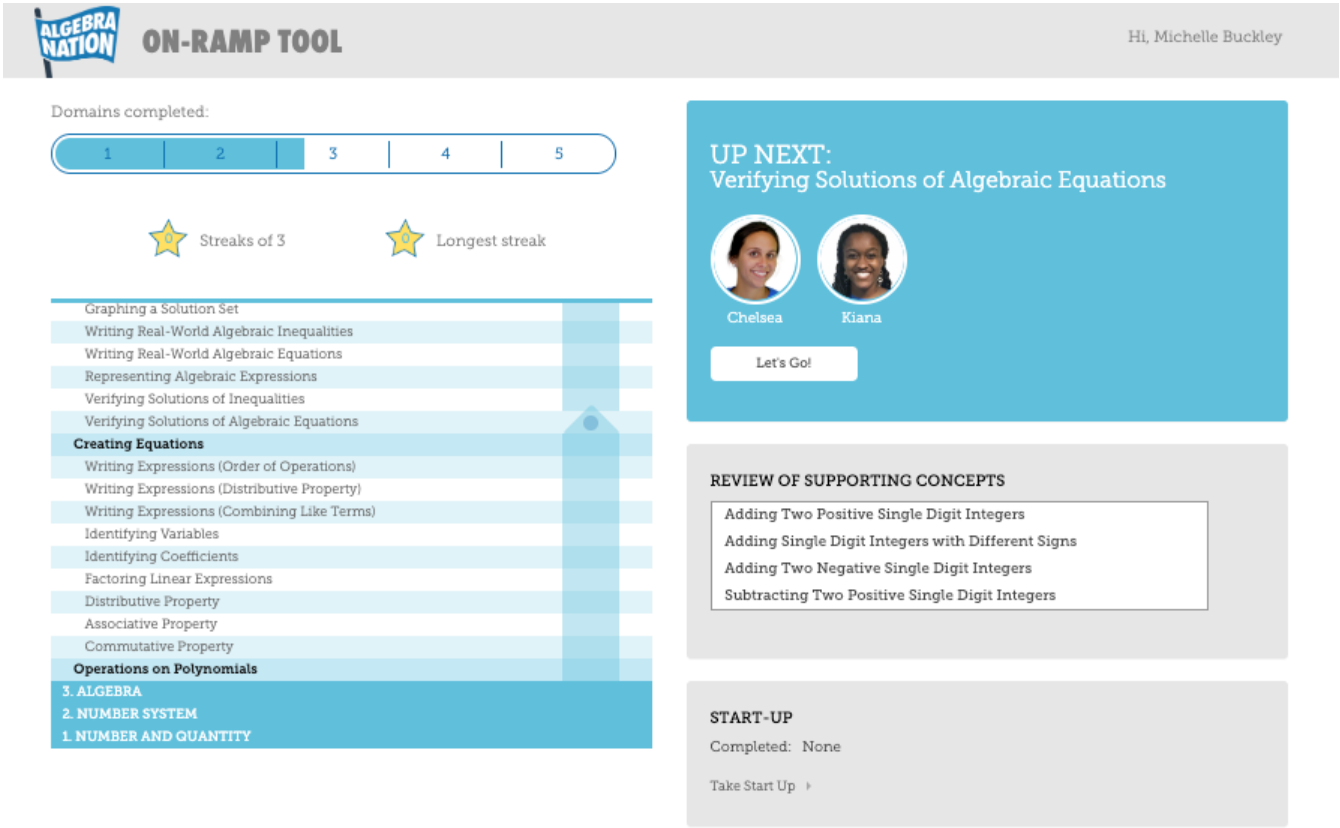
Kalinec-Craig, C.A. (2017). The Rights of the Learner: A Framework for Promoting Equity through Formative Assessment in Mathematics Education. *Democracy and Education*, 25 (2), Article 5.

How Do We Meet the Needs of Struggling Learners?

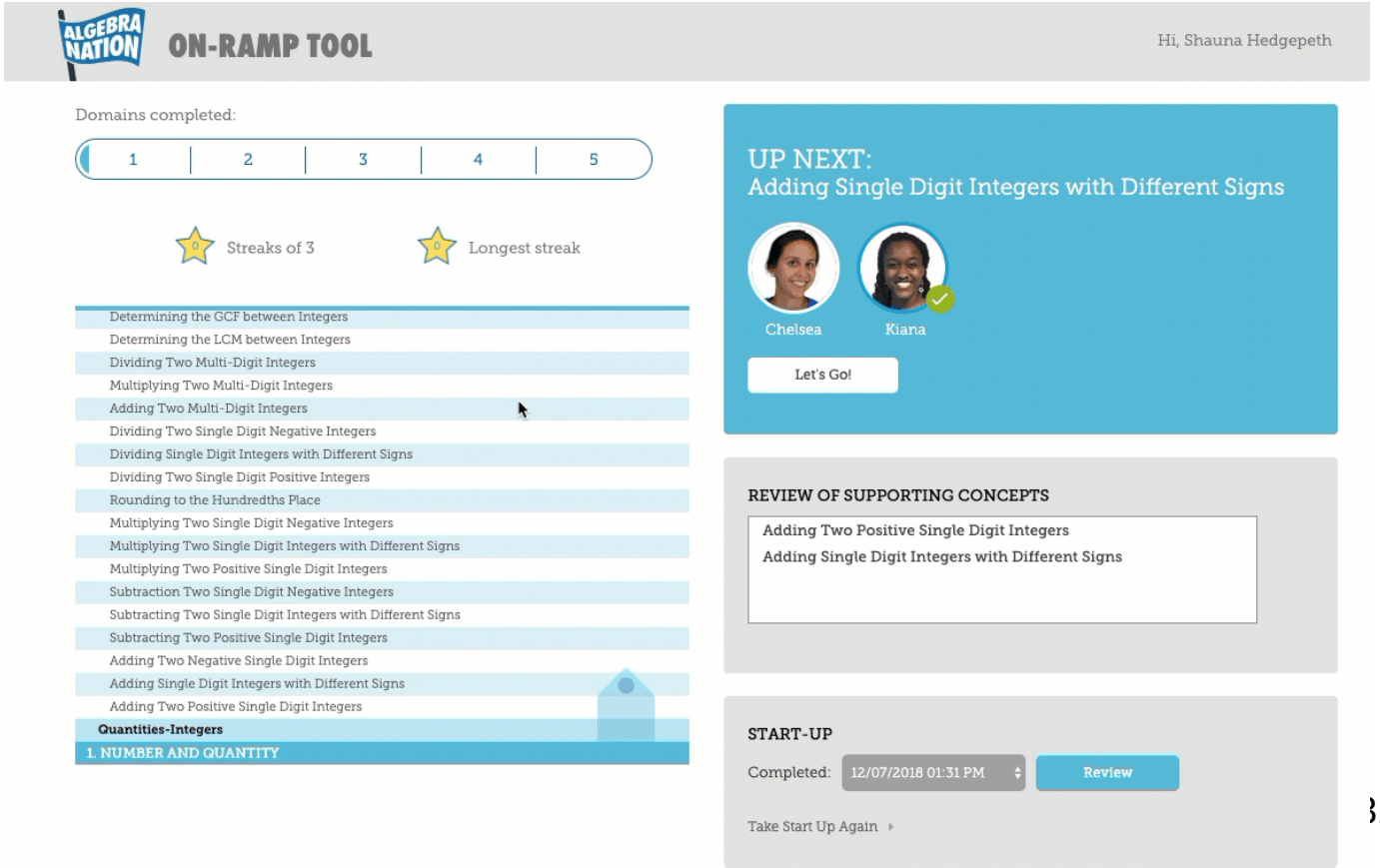
Creating a culture where productive struggle is expected.

How Do I Identify Standards for Struggling Learners?

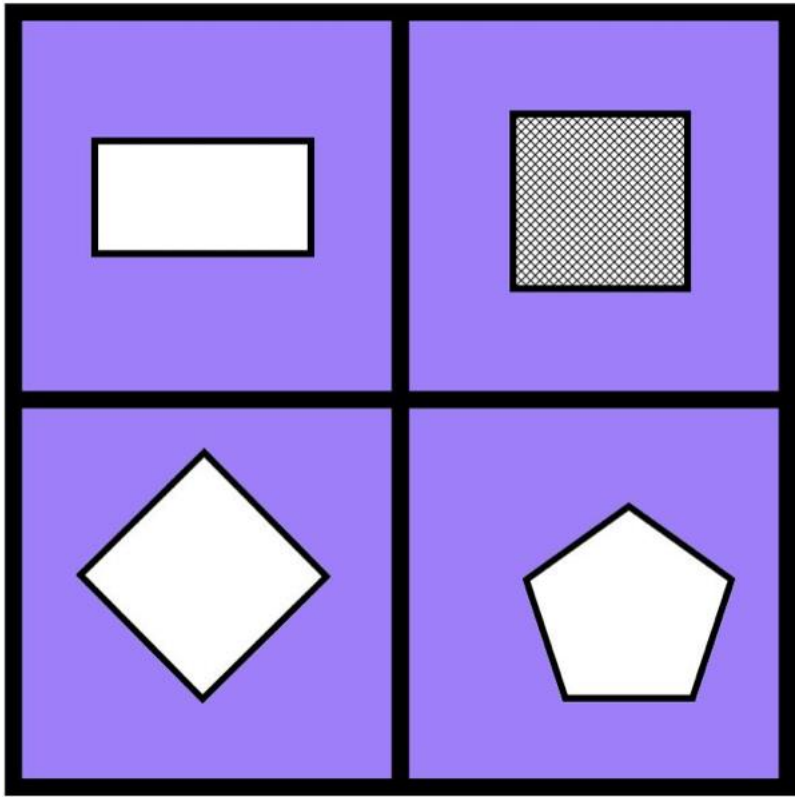
How Do I Identify Topics for Each Struggling Learner?

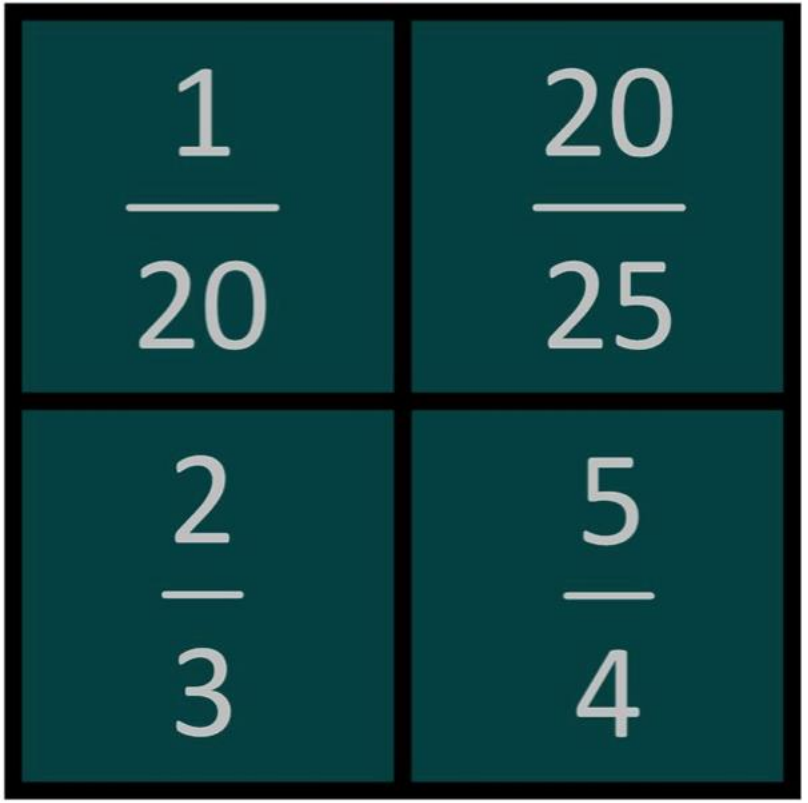


How Can Each Learner Identify Topics for Remediation?



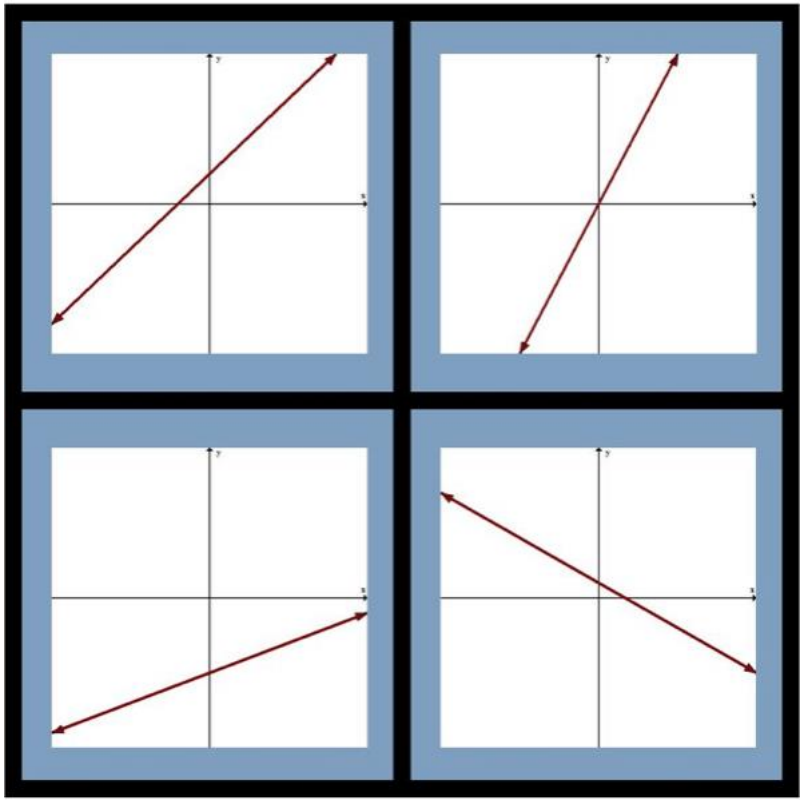
Resource: Which One Doesn't Belong



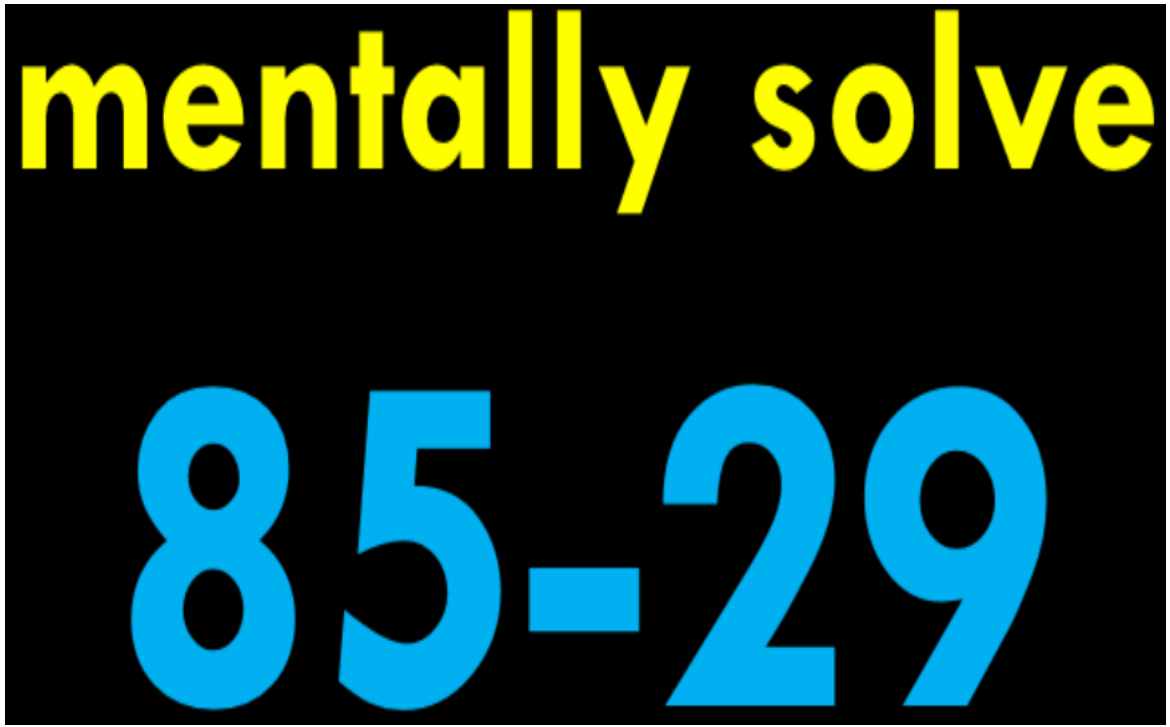


Resource: Which One Doesn't Belong

$y = 4x$	$y = x + 7$
$y = -2x + 4$	$y = 3x - 1$

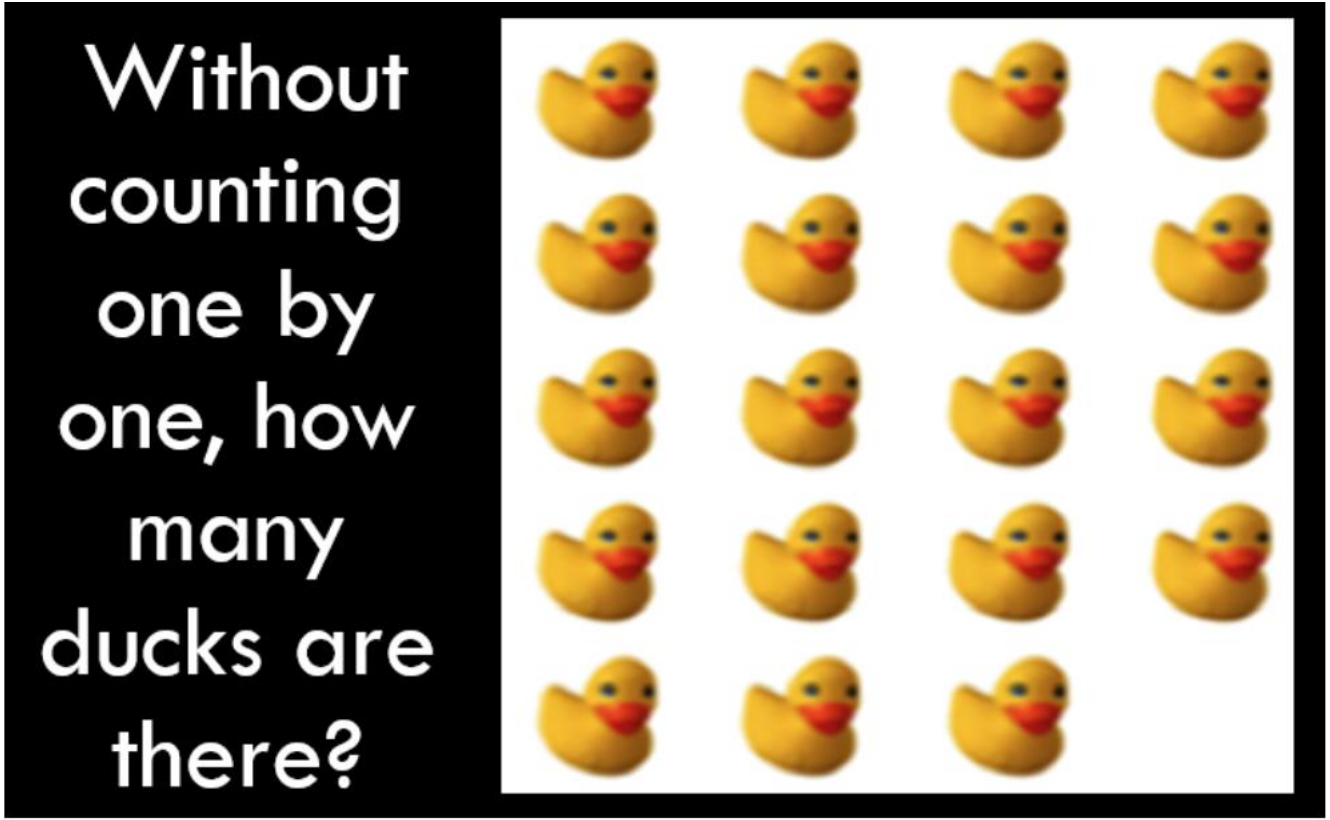


Number Talks



https://saravanderwerf.com/2016/06/27/secondary-number-talks-ill-convince-you-with-ducks/

Number Talks



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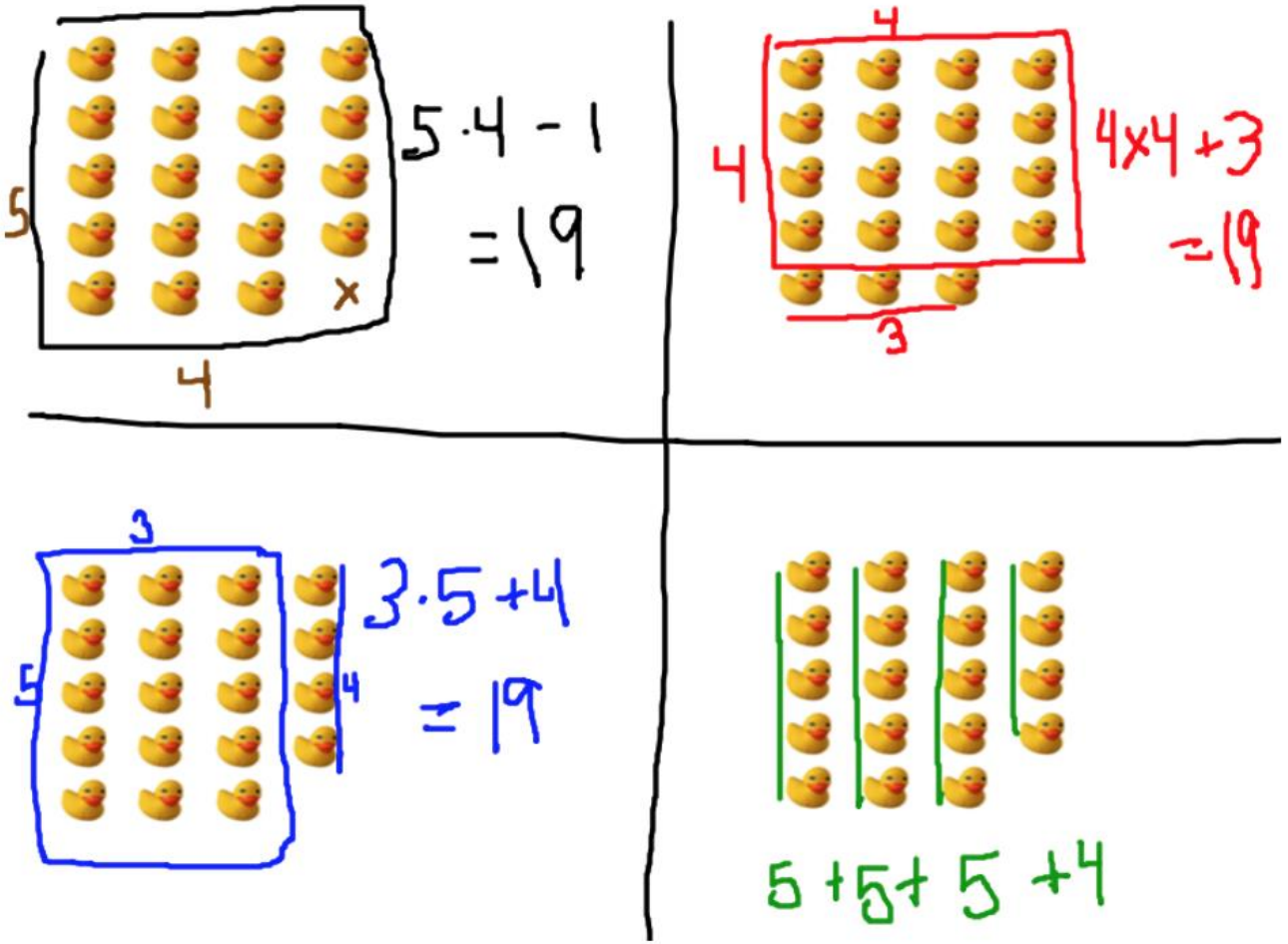
Number Talks

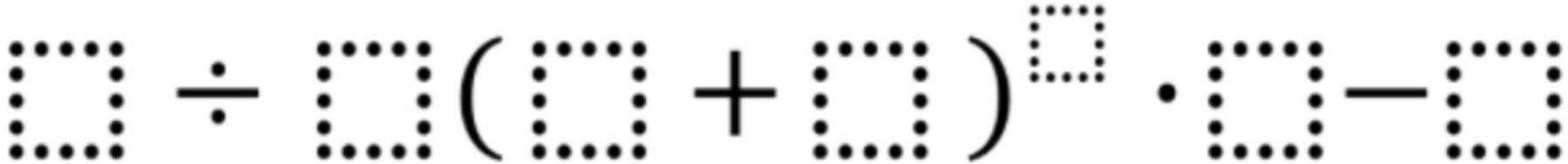


https://saravanderwerf.com/2016/06/27/secondary-number-talks-ill-convince-you-with-ducks/

Resource: Open Middle

ORDER OF OPERATIONS

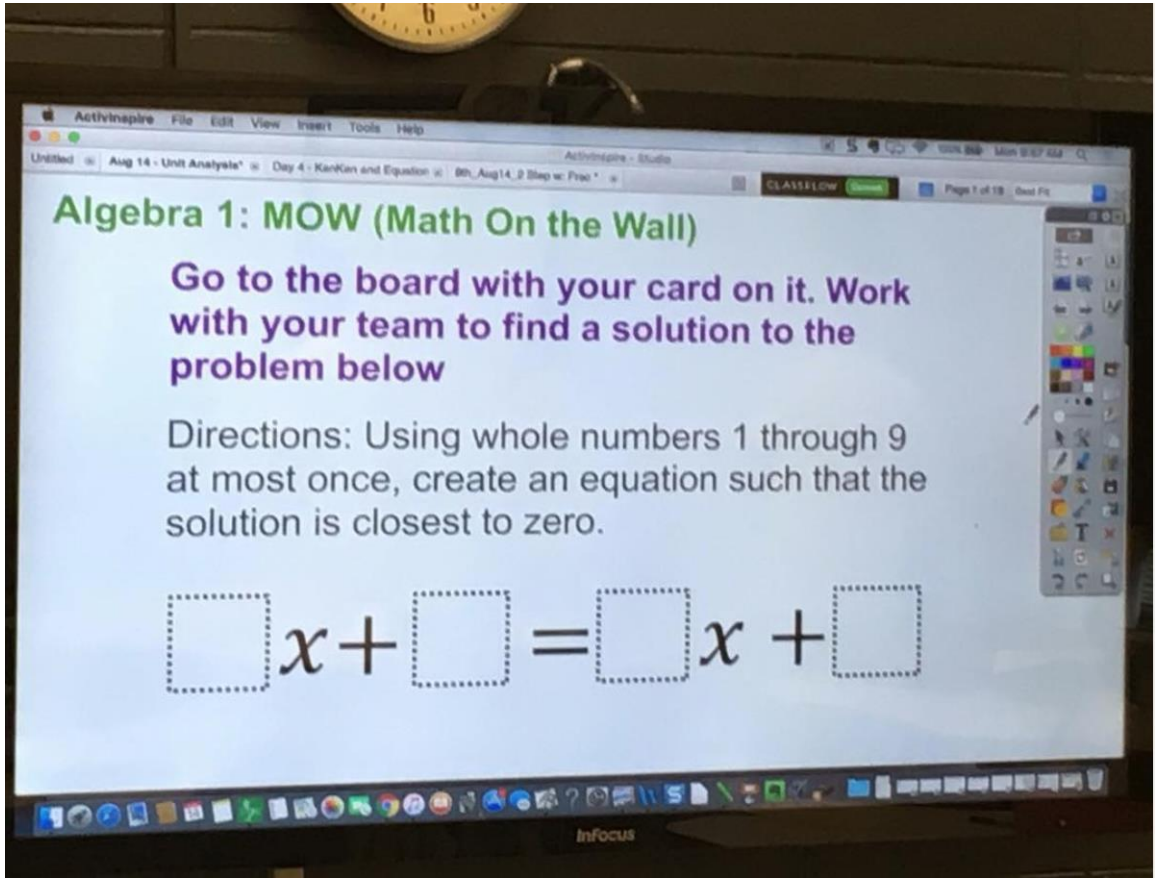
Directions: Make the largest (or smallest) expression by using the whole numbers 0-9 in the boxes below.
Note: for 5th grade, remove the exponent to make it grade level appropriate.



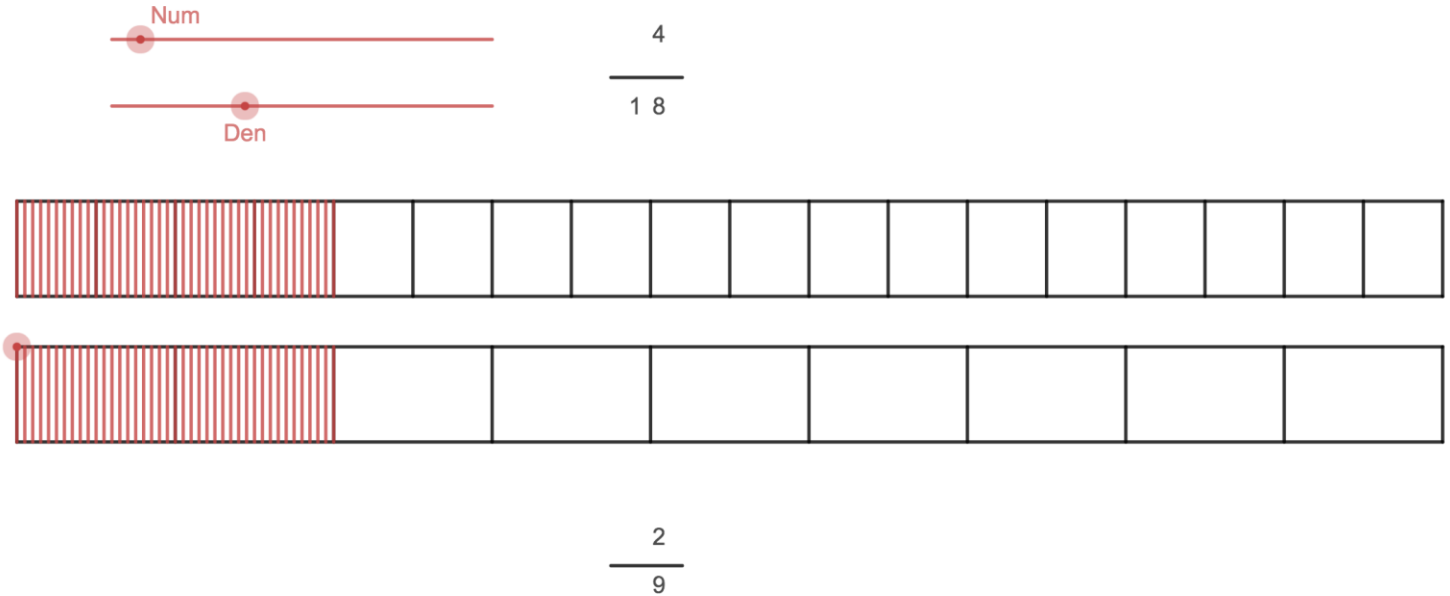
http://www.openmiddle.com/order-of-operations-2/

6.EE.2c

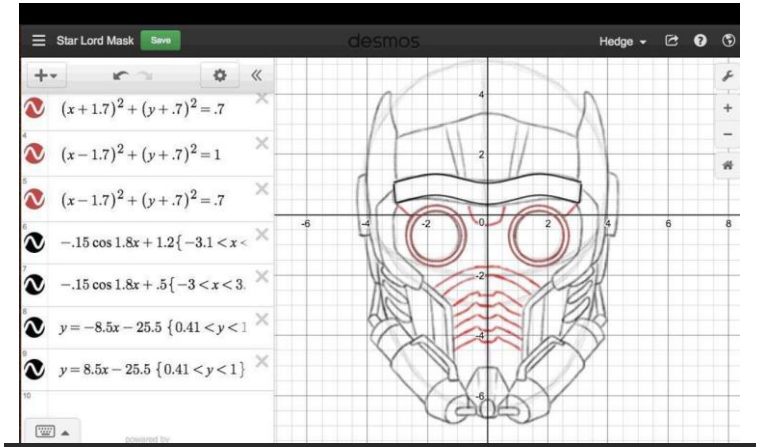
Resource: Open Middle

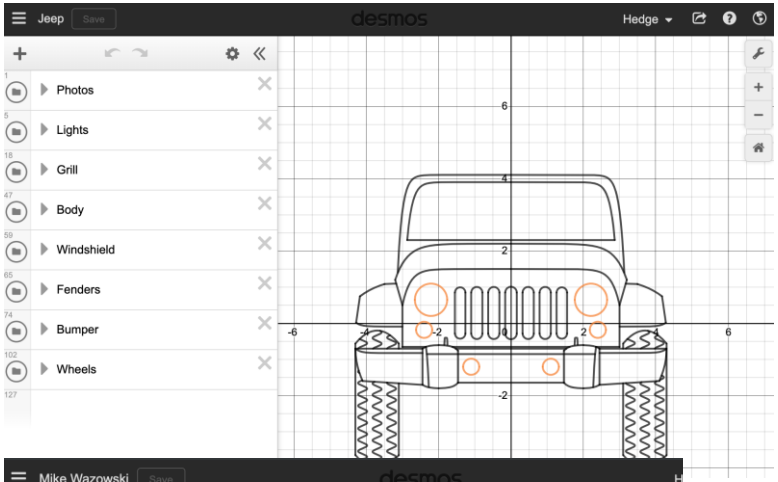


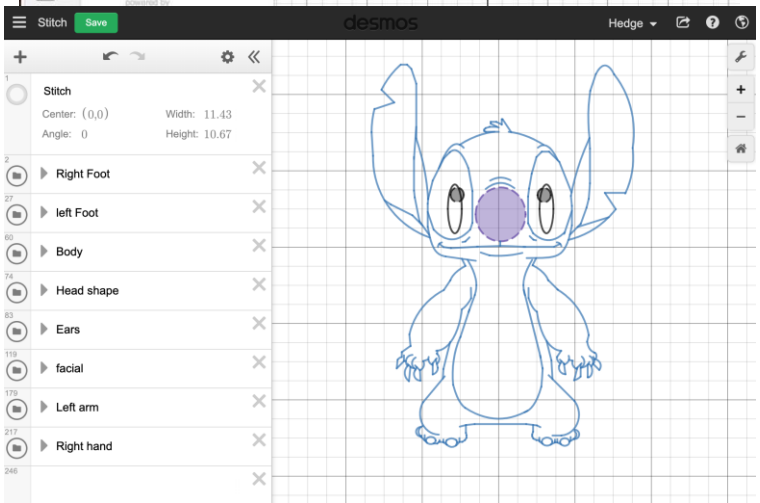
Resource: Desmos

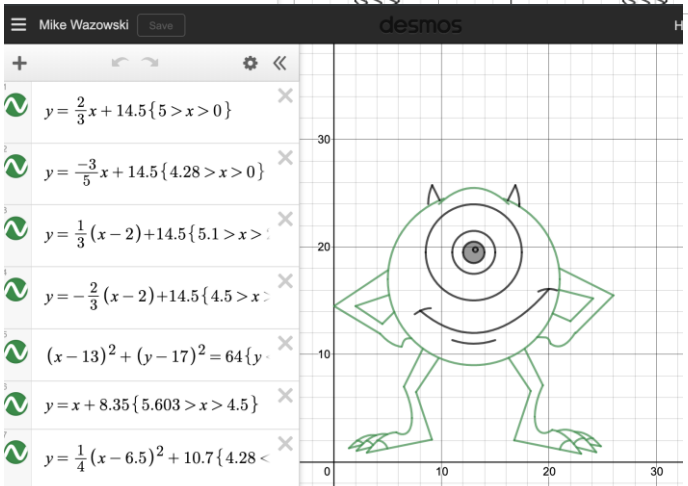


Desmos Calculator









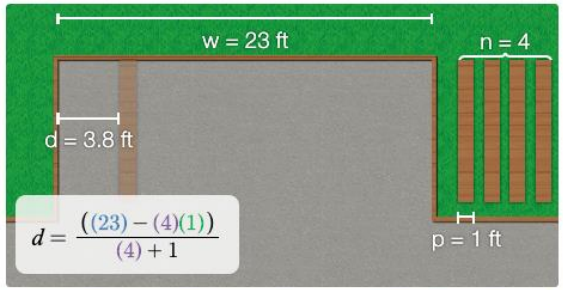
Resource: Desmos Activity Builder

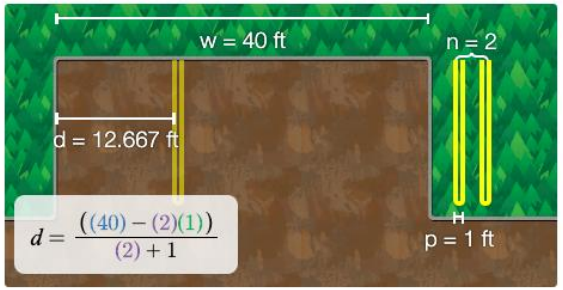
The number of dividers can change now.
How wide should each space be if there are n dividers?

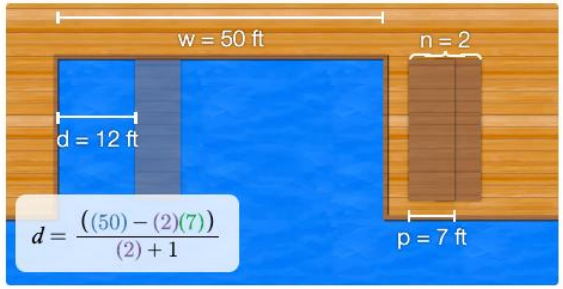
w is the width of the lot
p is the width of each divider
n is the number of dividers

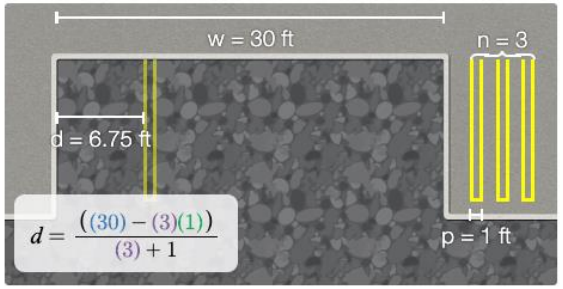
$d = \dfrac{(w - np)}{n + 1}$ ft

Try it









Land the Plane

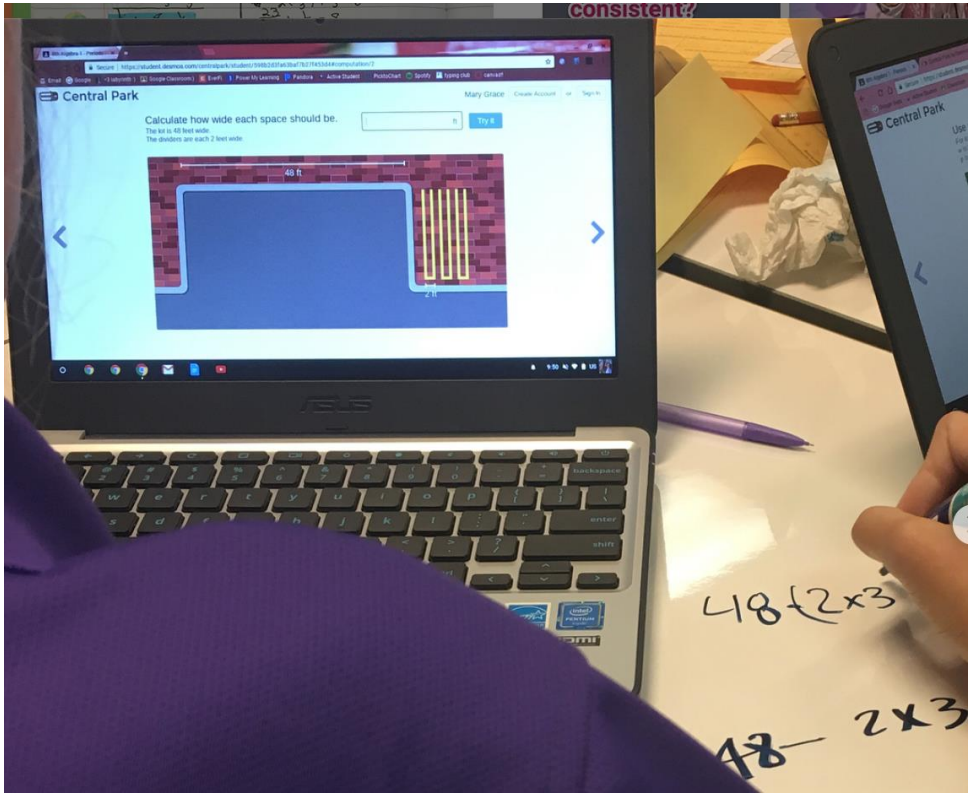
Move the plane so it lands safely.

Press "Submit" to check your answer.

(Note: At this airport, a safe landing sends the plane precisely down the middle of the runway.)

Submit

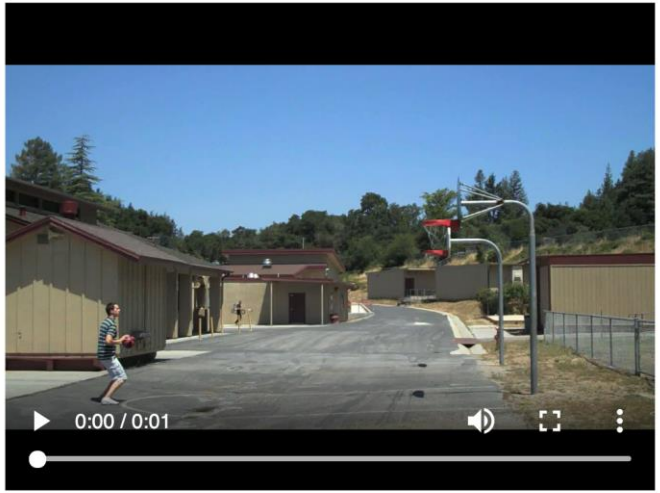
Resource: Desmos Activity Builder



“Will It Hit The Hoop?”

Screen 4 of 30

Shot #1 – Predict



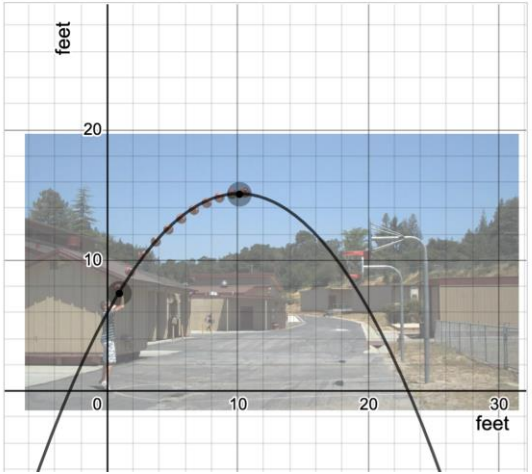
Press the play button. Then tell us:

What's your best guess? Does the ball go in or out?

In | Out

Screen 11 of 30

Shot #1 – Analyze



Drag the black points to transform the parabola and help you decide if the ball goes in the hoop or not.

In | Out

Submit to Teacher

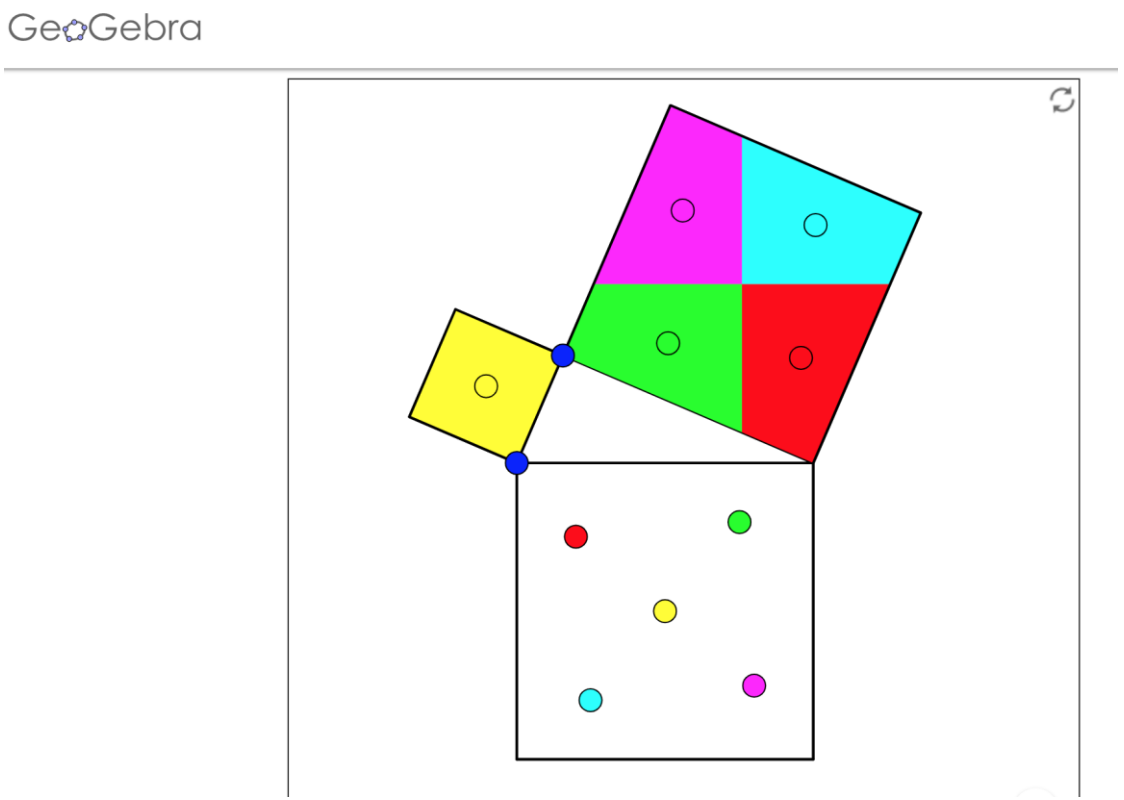
Desmos Activity Builder: Let's Try It!

Hey, students!

Go to student.desmos.com
and type in:

Y3T Z9H

Resource: Geogebra



Resource: Open Up Resources (authored by Illustrative Mathematics)

6.3: Which Would You Rather Solve?

Here are a lot of equations:

A. $-\frac{5}{6}(8+5b) = 75 + \frac{5}{3}b$

B. $-\frac{1}{2}(t+3) - 10 = -6.5$

C. $\frac{10-v}{4} = 2(v+17)$

D. $2(4k+3) - 13 = 2(18-k) - 13$

E. $\frac{n}{7} - 12 = 5n + 5$

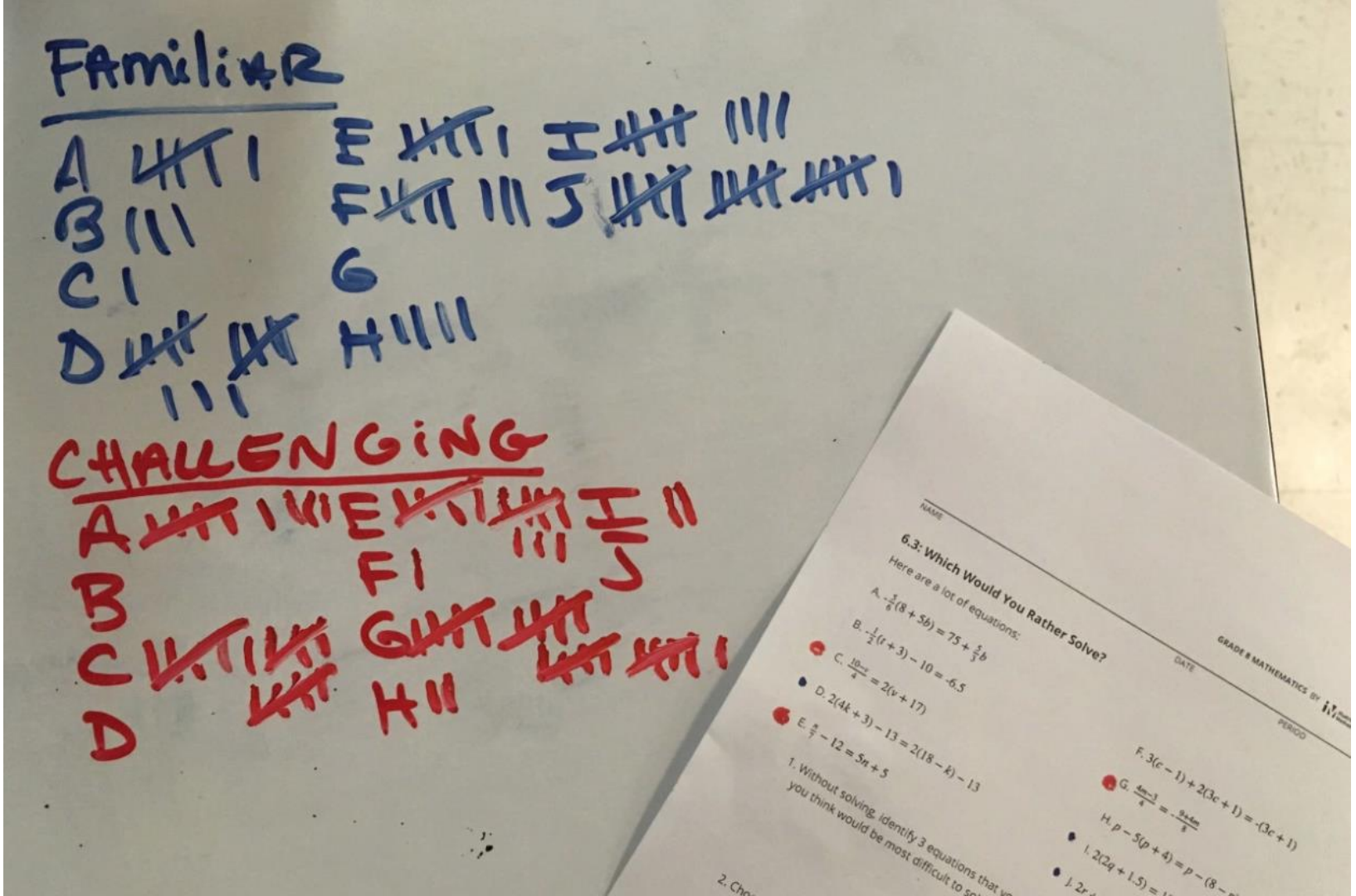
F. $3(c-1) + 2(3c+1) = -(3c+1)$

G. $\frac{4m-3}{4} = -\frac{9+4m}{8}$

H. $p - 5(p+4) = p - (8-p)$

I. $2(2q+1.5) = 18 - q$

J. $2r + 49 = -8(-r-5)$


Familiar
A
B
C 1
D
E
F
G 6
H
I
J
CHALLENGING
A
B
C
D
E
F 1
G
H
I
J
NAME
6.3: Which Would You Rather Solve?
DATE
GRADE 8 MATHEMATICS
PERIOD
Here are a lot of equations:
A. $-\frac{1}{6}(8+5b) = 75 + \frac{5}{3}b$
B. $-\frac{1}{2}(r+3) - 10 = -6.5$
C. $\frac{10-r}{4} = 2(v+17)$
D. $2(4k+3) - 13 = 2(18-k) - 13$
E. $\frac{n}{7} - 12 = 5n + 5$
F. $3(c-1) + 2(3c+1) = -(3c+1)$
G. $\frac{4m-1}{4} = -\frac{9+4m}{8}$
H. $p - 5(p+4) = p - (8 -$
I. $2(2q + 1.5) =$
J. $2r$
1. Without solving, identify 3 equations that
you think would be most difficult to
2. Cho

Resource: Open Up Resources (authored by Illustrative Mathematics)

Unit 1, Lesson 7: Scale Drawings

Let's explore scale drawings.

1.7.1 Warm-Up: What is a Scale Drawing?

Here are some drawings of a school bus, a quarter, and the subway lines around Boston, Massachusetts. The first three drawings are **scale drawings** of these objects.

1.7.2 Exploration Activity: Sizing Up a Basketball Court

Your teacher will give you a scale drawing of a basketball court. The drawing does not have any measurements labeled, but it says that 1 centimeter represents 2 meters.

1. Measure the distances on the scale drawing that are labeled a–d to the nearest tenth of a centimeter. Record your results in the first row of the table.
2. The statement "1 cm represents 2 m" is the **scale** of the drawing. It can also be expressed as "1 cm to 2 m," or "1 cm for every 2 m." What do you think the scale tells us?

Unit 2: Introducing Proportional Relationships

Section 1: Representing Proportional Relationships with Tables

Lesson 1: One of These Things Is Not Like the Others 63
- ☐ *I can use equivalent ratios to describe scaled copies of shapes.*
- ☐ *I know that two recipes will taste the same if the ingredients are in equivalent ratios.*

Lesson 2: Introducing Proportional Relationships with Tables 67
- ☐ *I understand the terms proportional relationship and constant of proportionality.*
- ☐ *I can use a table to reason about two quantities that are in a proportional relationship.*

Lesson 3: More about Constant of Proportionality 71

3.10.4a Exploration Activity: Analyzing Circle Claims

Here are two students' answers for each question. Do you agree with either of them? Explain or show your reasoning.

1. How many feet are traveled by a person riding once around the merry-go-round?

- Clare says, "The radius of the merry-go-round is about 4 feet, so the distance around the edge is about 8π feet."
- Andre says, "The diameter of the merry-go-round is about 4 feet, so the distance around the edge is about 4π feet."

2. How much room is there to spread frosting on the cookie?

- Clare says "The radius of the cookie is about 3 centimeters, so the space for frosting is about 6π cm^2."
- Andre says "The diameter of the cookie is about 3 inches, so the space for frosting is about 2.25π in^2."

Unit 3, Lesson 10: Distinguishing Circumference and Area

Let's contrast circumference and area.

3.10.1 Warm-Up: Filling the Plate

About how many cheese puffs can fit on the plate in a single layer? Be prepared to explain your reasoning.

3.10.2 Exploration Activity: Card Sort: Circle Problems

Your teacher will give you cards with questions about circles.

1. Sort the cards into two groups based on whether you would use the circumference or the area of the circle to answer the question. Pause here so your teacher can review your work.
2. Your teacher will assign you a card to examine more closely. What additional information would you need in order to answer the question on your card?
3. Estimate measurements for the circle on your card.
4. Use your estimates to calculate the answer to the question.

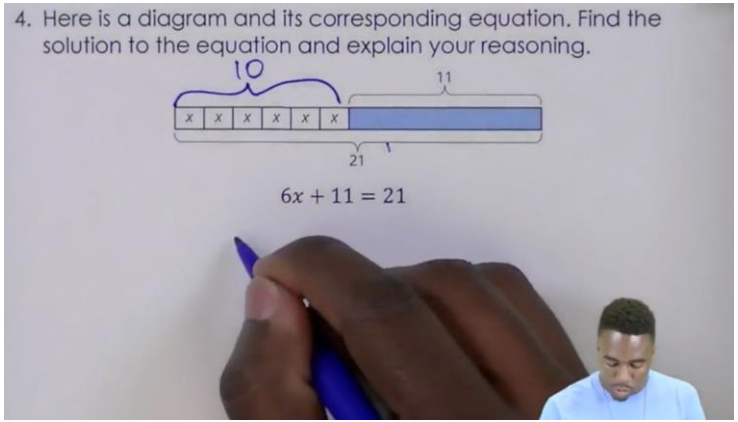
3.10.3 Exploration Activity: Visual Display of Circle Problem

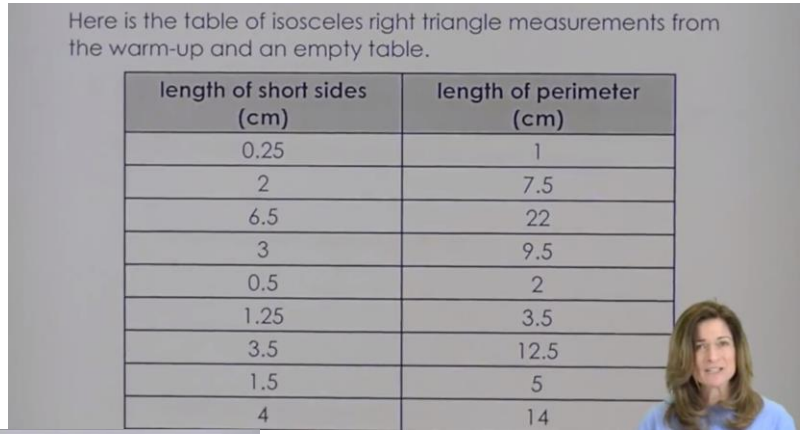
In the previous activity you estimated the answer to a question about circles.

Create a visual display that includes:

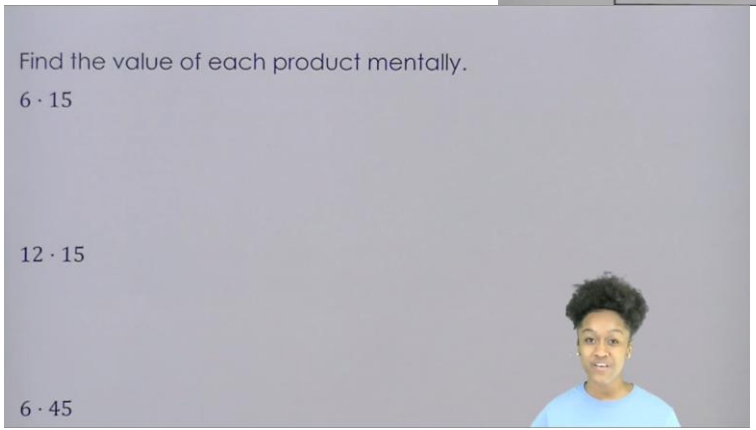
- The question you were answering
- A diagram of a circle labeled with your estimated measurements
- Your thinking, organized so that others can follow it
- Your answer, expressed in terms of π and also expressed as a decimal approximation

Resource: Open Up Resources (authored by Illustrative Mathematics)





length of short sides (cm)	length of perimeter (cm)
0.25	1
2	7.5
6.5	22
3	9.5
0.5	2
1.25	3.5
3.5	12.5
1.5	5
4	14



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Meeting the Needs of Struggling Learners Prior to Algebra 1

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