Math collaborative

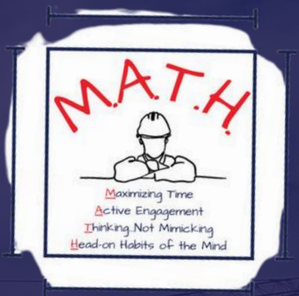
Columbus State University

Growing Curiosity

By Playing with Your Math

Peter Anderson

October 17th, 2024



Math collaborative

M.A.T.H.

MAXIMIZING TIME

ACTIVE ENGAGEMENT

THINKING...NOT MIMICKING

HABITS OF THE MIND

MAXIMIZING...

TEACHERS' AND STUDENTS' USE OF TIME; GEORGIA MATH CURRICULUM RESOURCES; STUDENT'S NATURAL CURIOSITY; STUDENTS' BACKGROUND KNOWLEDGE.

ACTIVE...

ENGAGEMENT, NOT PASSIVE LEARNERS; "COMPLIANCE IS NOT ENGAGEMENT" (VANDERWERF); REAL-WORLD AND/OR HANDS-ON LEARNING; SHIFTING THE COGNITIVE LOAD TO STUDENTS.

THINKING...

NOT MIMICKING; NOTICING/WONDERING; COMPARING/CONTRASTING; PROBLEM SOLVING.

HABITS OF THE MIND...

DO IT NOW! CREATING HABITS OF THE MIND, MATH PRACTICES, AND PROCESSES.

Your Guide

for today

Play with the lesson!

Let go of your teacher-ness for the day. There will be time for that.

You are smart!

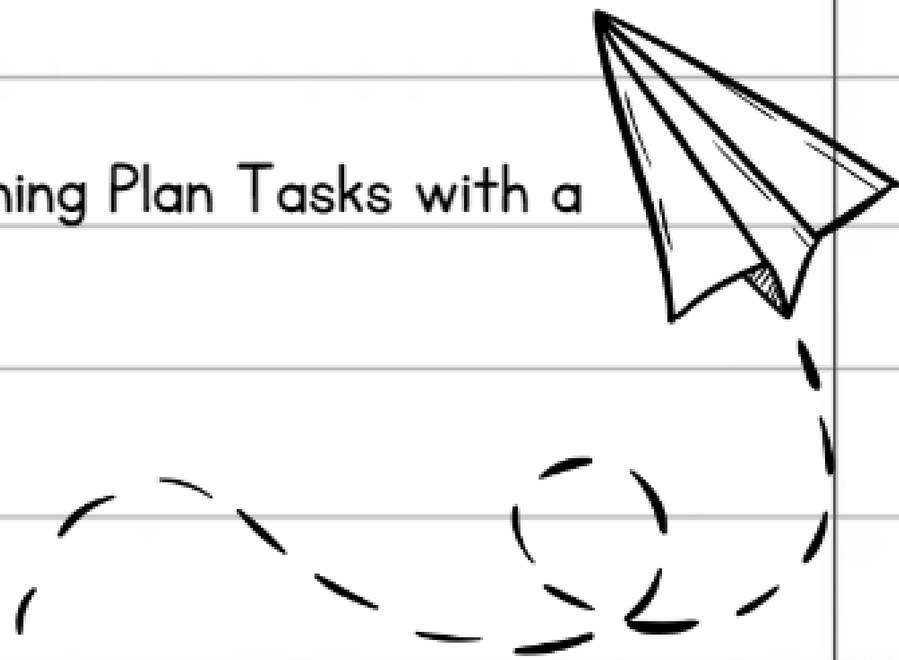
Everyone will be respected - and expected to be problem solvers!

Everyone is responsible to help their classmate learn!

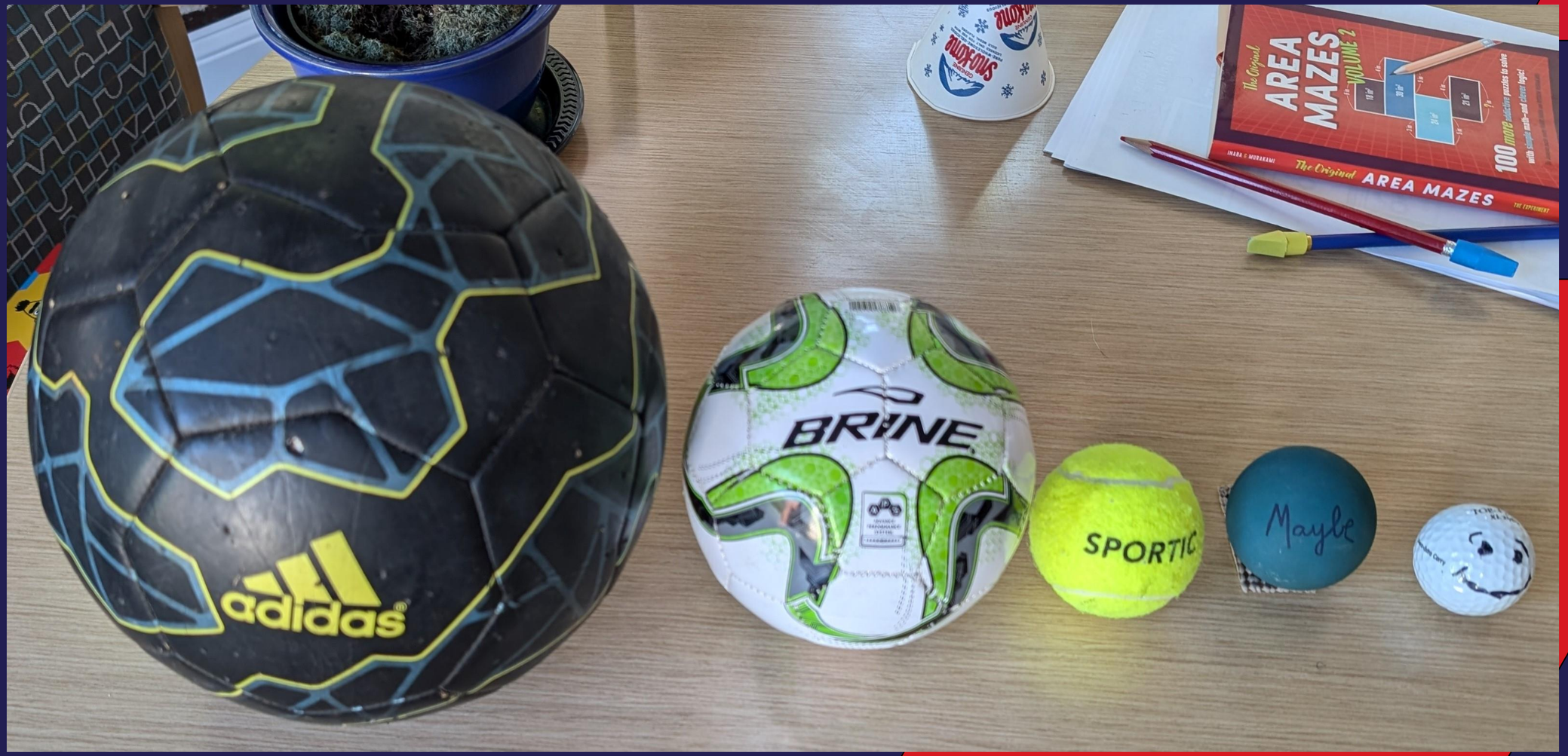
Learning Goals for Today

Learn how to:

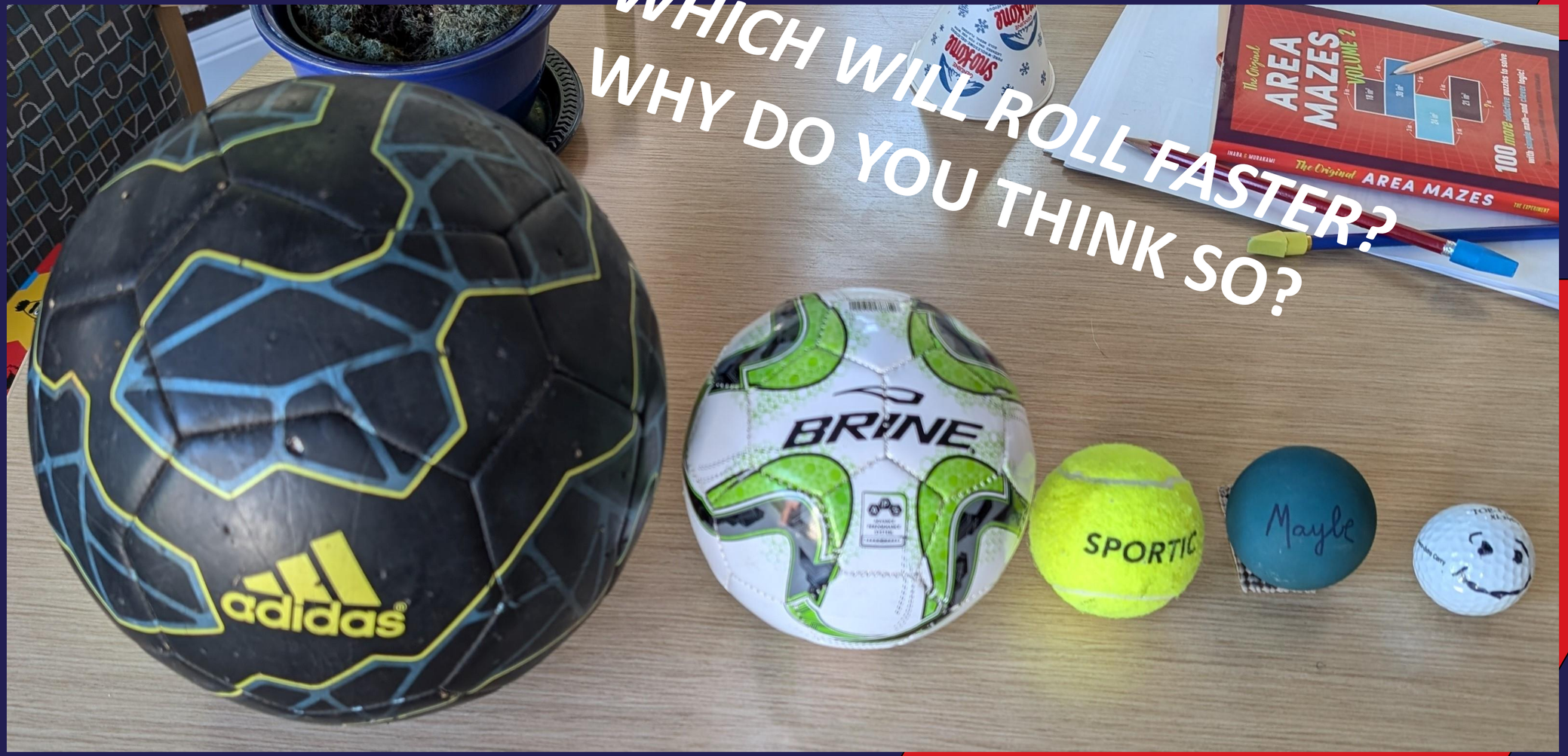
1. Play a little and learn a lot!
2. Focus on Math Practices
3. Focus on student engagement in a task.
4. Build Thinking Classroom principles into Learning Plan Tasks with a focus on flow.



Imagine Some Balls Rolling Down an Incline….



What things do you Wonder?



WHICH WILL ROLL FASTER? WHY DO YOU THINK SO?

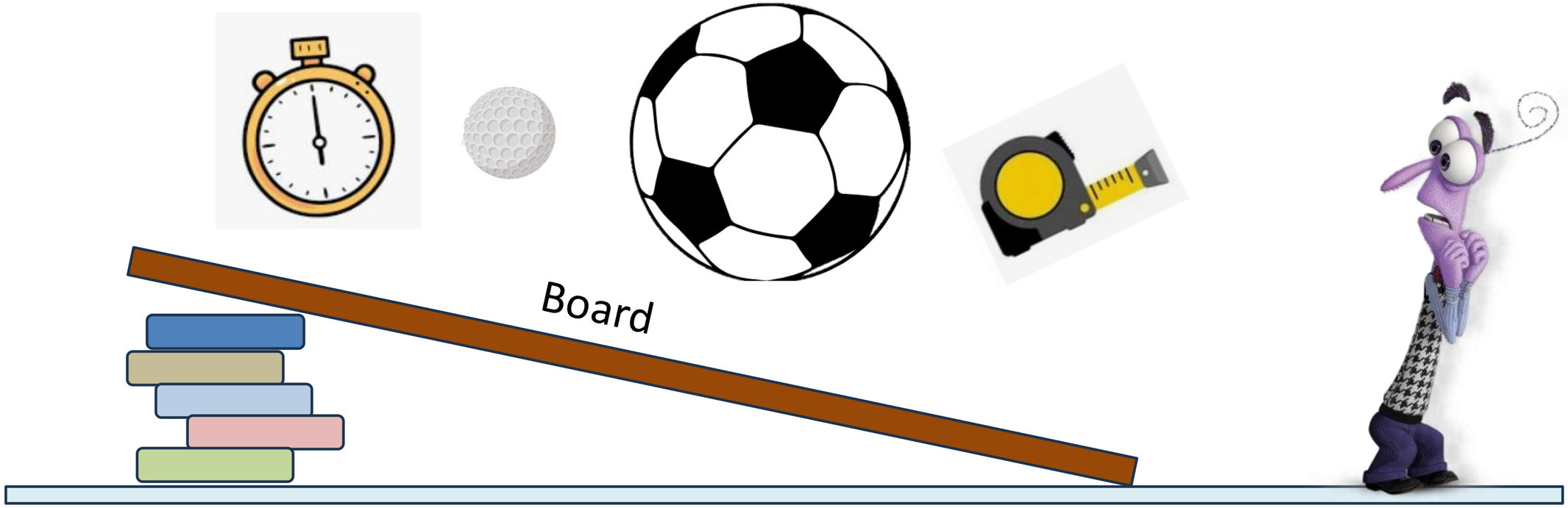
HOW CAN WE PREDICT WHEN A PARTICULAR BALL WILL BE AT A SPECIFIC DISTANCE?

Low Guess – High Guess – Best Guess

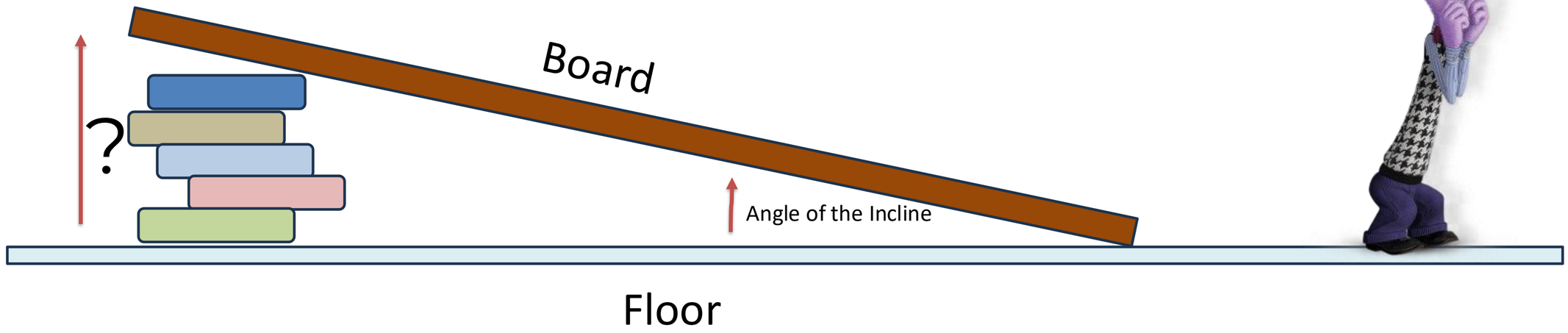
We will take the balls out to a ramp and see how our predictions hold up in the real world.

Type Ball	Soccer Ball	Medium Soccer	Mini Soccer	Mini Basketball	Miniature Basketball	Racquet Ball	Golf Ball
Low Guess							
High Guess							
Best Guess							

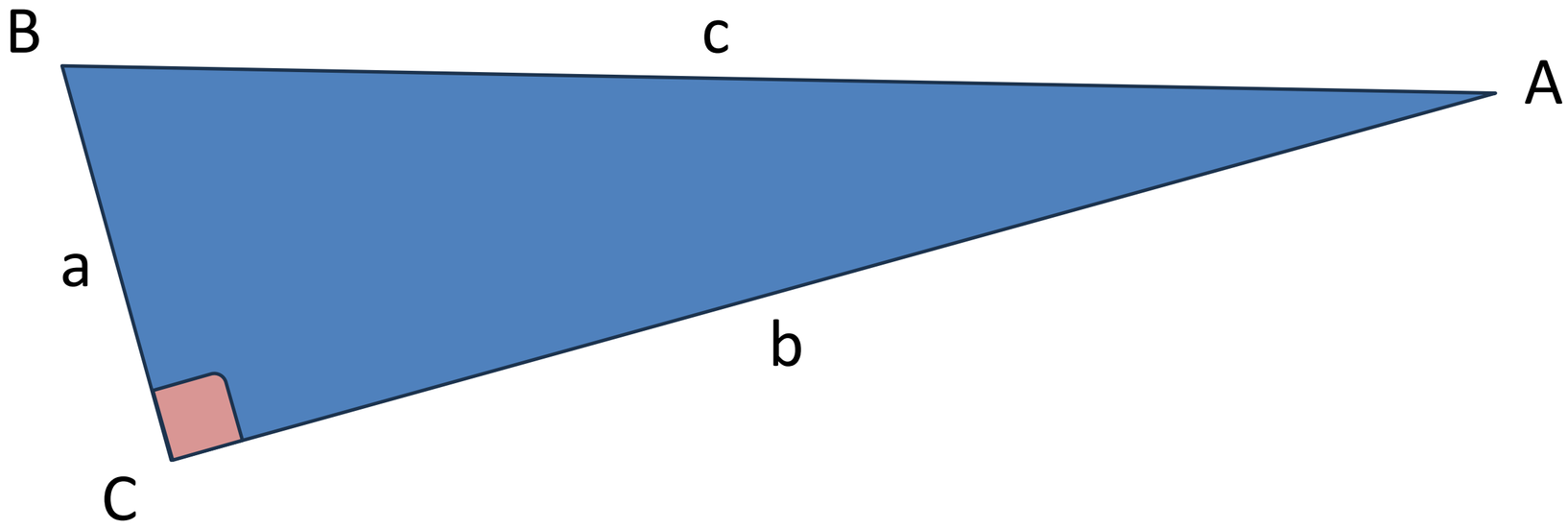
Using the materials provided, create a ramp that matches the incline.



Using the board provided, create a ramp that matches the incline.



WRITE ALL THAT YOU CAN ABOUT:



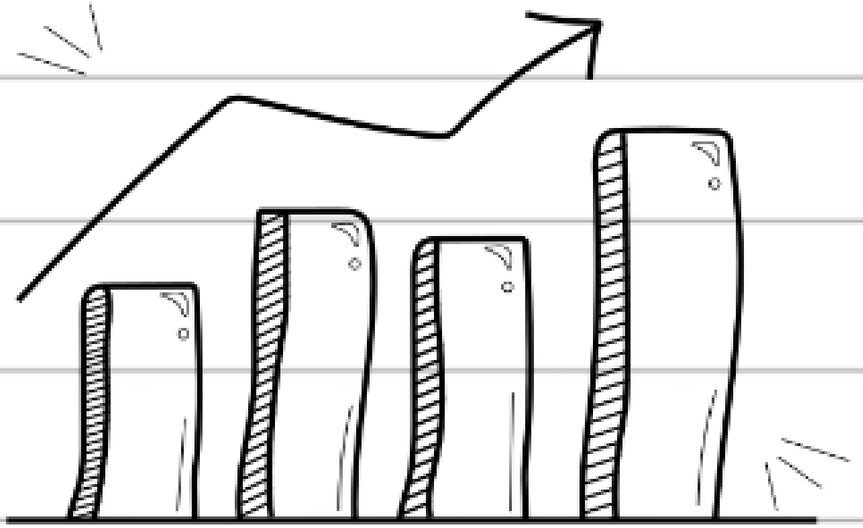
https://slamdunkmath.blogspot.com/search/label/Ball%20Roll%20Race

How could you use the ramp you just created to determine (as accurately as possible) the time it will take for a ball to roll _____ meters?

How should we collect data?

How can we represent the data?

How can we make sense of the data?



Ball Type:	
Time of all trials	Distance (cm)
	First distance up the ramp
	Second distance up the ramp
	Third distance up the ramp
	Fourth distance up the ramp
	Total distance up the ramp

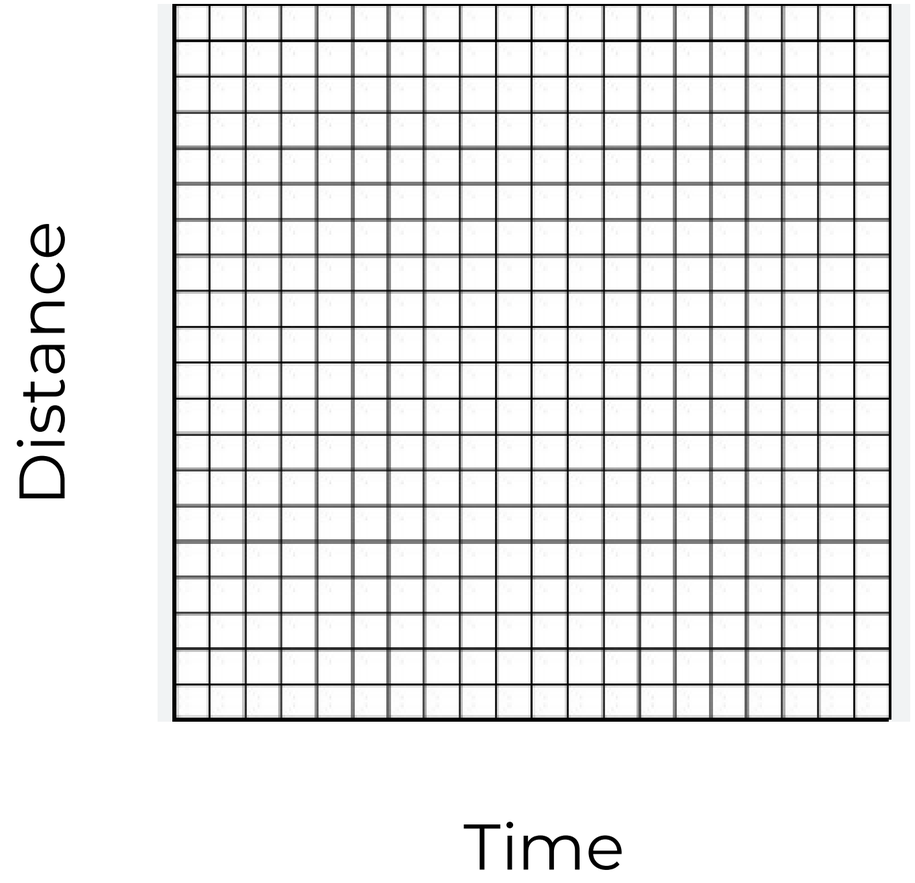
Group Number:

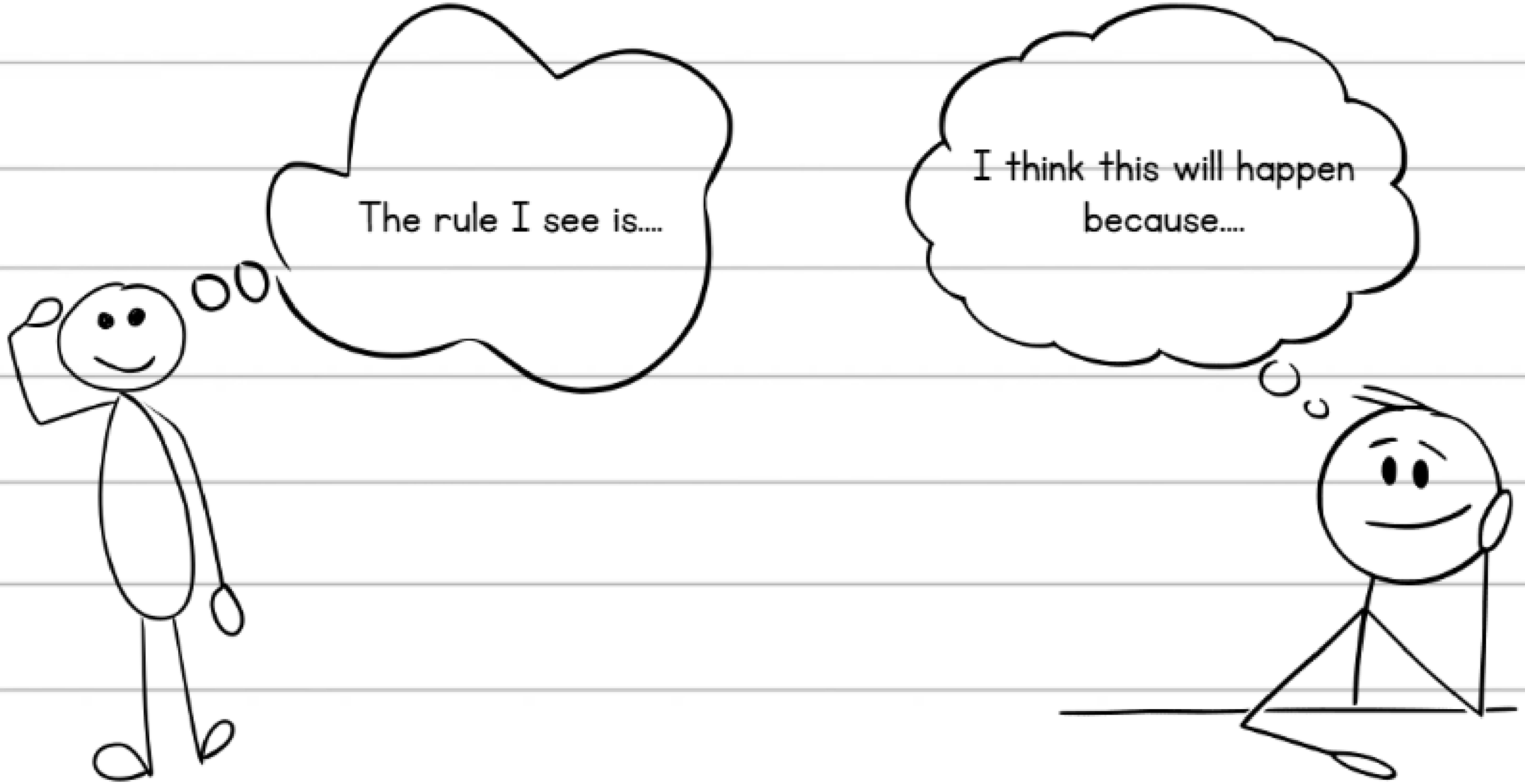
Group Member's Names:

Ball #1		Ball #2		Ball #3	
Time of all trials	Distance (cm)	Time of all trials	Distance (cm)	Time of all trials	Distance (cm)
	First distance up the ramp		First distance up the ramp		First distance up the ramp
	Second distance up the ramp		Second distance up the ramp		Second distance up the ramp
	Third distance up the ramp		Third distance up the ramp		Third distance up the ramp
	Fourth distance up the ramp.		Fourth distance up the ramp.		Fourth distance up the ramp.
	Total Distance of the Ramp		Total Distance of the Ramp		Total Distance of the Ramp

ORGANIZE DATA AND LOOK FOR PATTERNS

Time	Distance




The rule I see is....
I think this will happen because....

KEEP IT OR TRADE IT?

Let’s look at each other’s work and ask questions

What parts of your work will you keep, and what parts would you trade for the work of others in the class?

??

Keep It or Trade It

Ball Type	Calculated Time for ___ meters	Why are you keeping the Calculated time	Traded Time to Travel ___ Meters	Group Number	Why are you trading for this new time?	Final Ranking for order of finish
Soccer						
Medium Soccer						
Mini Soccer						
Mini Basketball						
Miniature Basketball						
Racquet Ball						
Golf Ball						

IT IS TIME TO ROLL!

We will take the balls out to a ramp and see how our predictions hold up in the real world.

Type Ball	Soccer Ball	Medium Soccer	Mini Soccer	Mini Basketball	Miniature Basketball	Racquet Ball	Golf Ball
What is the rule for predicting time?							
Predicted Times							
Actual Time							
Actual Finishing Order							

What Questions Do We Still Have?

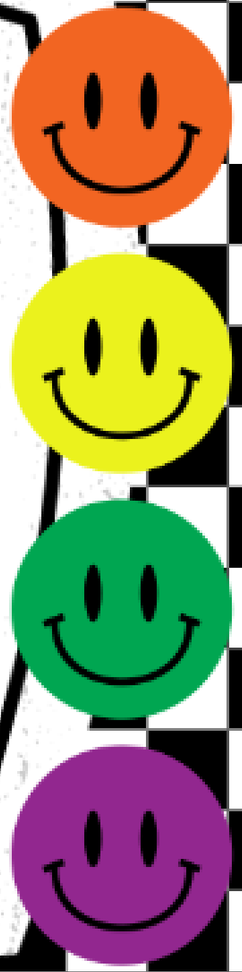
What Did

We Learn?

Rolling It All Together

Soccer Ball		**Mini Basketball**		**Racquet Ball**		**Golf Ball**	
Time (sec)	Distance (cm)	Time (sec)	Distance (cm)	Time (sec)	Distance (cm)	Time (sec)	Distance (cm)
Linear Regression		Linear Regression		Linear Regression		Linear Regression	
Quadratic Regression		Quadratic Regression		Quadratic Regression		Quadratic Regression	

What Does This Mean for My Teaching?



BUILDING THINKING CLASSROOMS

Research: @pgliljedahl
Sketchnote: @wheeler_laura

① Begin w/ a Problem

Give a problem-solving task

To start:
Problems should be
- ☐ engaging
- ☐ non-curricular
- ☐ collaborative

↳ promote talking

Later:
Problems can be curricular
eg textbook problems

② Visibly Random Groups

- ☐ Randomly assigned eg playing cards
- ☐ Daily & in front of students
- ☐ 2 or 3 students / group

- ☐ Sit & stand together

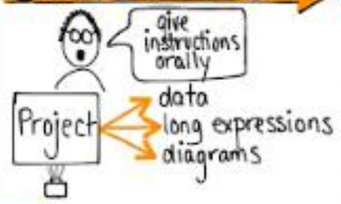
③ Vertical Non-Permanent Surfaces

- ☐ Vertical
- ☐ Erasable

- ☐ 1 marker or chalk per group

↳ promotes discussion

④ Oral Instructions



→ groups will discuss (instead of decoding text)

⑤ Defront the room

Desks
- orient in various directions
- pull away from wall (room to stand @ VNPS)

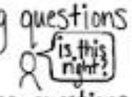
Teacher addresses the class from a variety of locations.

⑥ Answering Questions

Acknowledge, but don't answer:

✗ Proximity questions (b/c teacher is close by)

✗ Stop thinking questions



Answer:

✓ Keep thinking questions

↳ give HINTS not answers

⑦ Meaningful Notes

Student created:
- select
- synthesize → ideas
- reorganize

Based on their & others' boards

Provide time for this after levelling.

⑧ Build Autonomy

- ☐ Model how groups can visit other groups when they are stuck or done.
- ☐ Hints & extensions come from peers (not just the teacher).

→ Helps manage flow

⑨ Hints & Extensions

↳ Manage flow

⑩ Level to the Bottom

- debrief
- class discussion
- direct teaching
- the "lesson"

Once all groups pass a minimum threshold.

Debrief 1 or more groups' solutions

Work through a new problem w/ whole group

⑪ Check Understanding

Assign 4-6 "check for understanding" questions

Students choose to work
- individually
- in groups
  - at desks
  - on VNPS

Purpose: self-evaluation (NOT marks)

⑫ Formative Assessment

~~measure~~ → communicate

Where student is currently → Where student is going

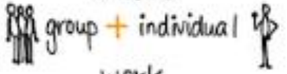
Multiple & varied opportunities to demonstrate learning

⑬ Summative Assessment

PROCESS > product

Evaluate what you value!

Include:



group + individual work

⑭ Reporting

Based on data (~~points~~)

~~One aggregated mark~~

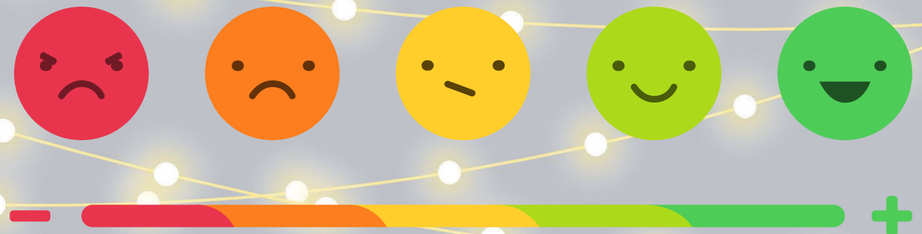
↳ disaggregated evidence

Analysis of data > Counting of points

What has this student learned?

What can they improve?

HOW DID WE DO?



Fill out this quick survey to evaluate Session 105!

Peter Anderson

- Growing Your Curiosity-

SCAN ME!

NOTES to NERDS

The official newsletter of the Math Collaborative

Math collaborative

WE ARE PROUD OF OUR
BI-MONTHLY NEWSLETTER!
EVERY EDITION INCLUDES:

A HEART-FELT MESSAGE FROM
OUR CRMC DIRECTOR,
PROFESSIONAL DEVELOPMENT OPPORTUNITIES,
TEACHING RESOURCES,
...AND SO MUCH MORE!

PRESENT AND PAST EDITIONS
ARE POSTED ON OUR WEBSITE @
WWW.COLUMBUSSTATE.EDU/CRMC/DIRECTORS-BLOG.PHP

WANT TO RECEIVE YOUR OWN COPY?
SIGN-UP TODAY!:

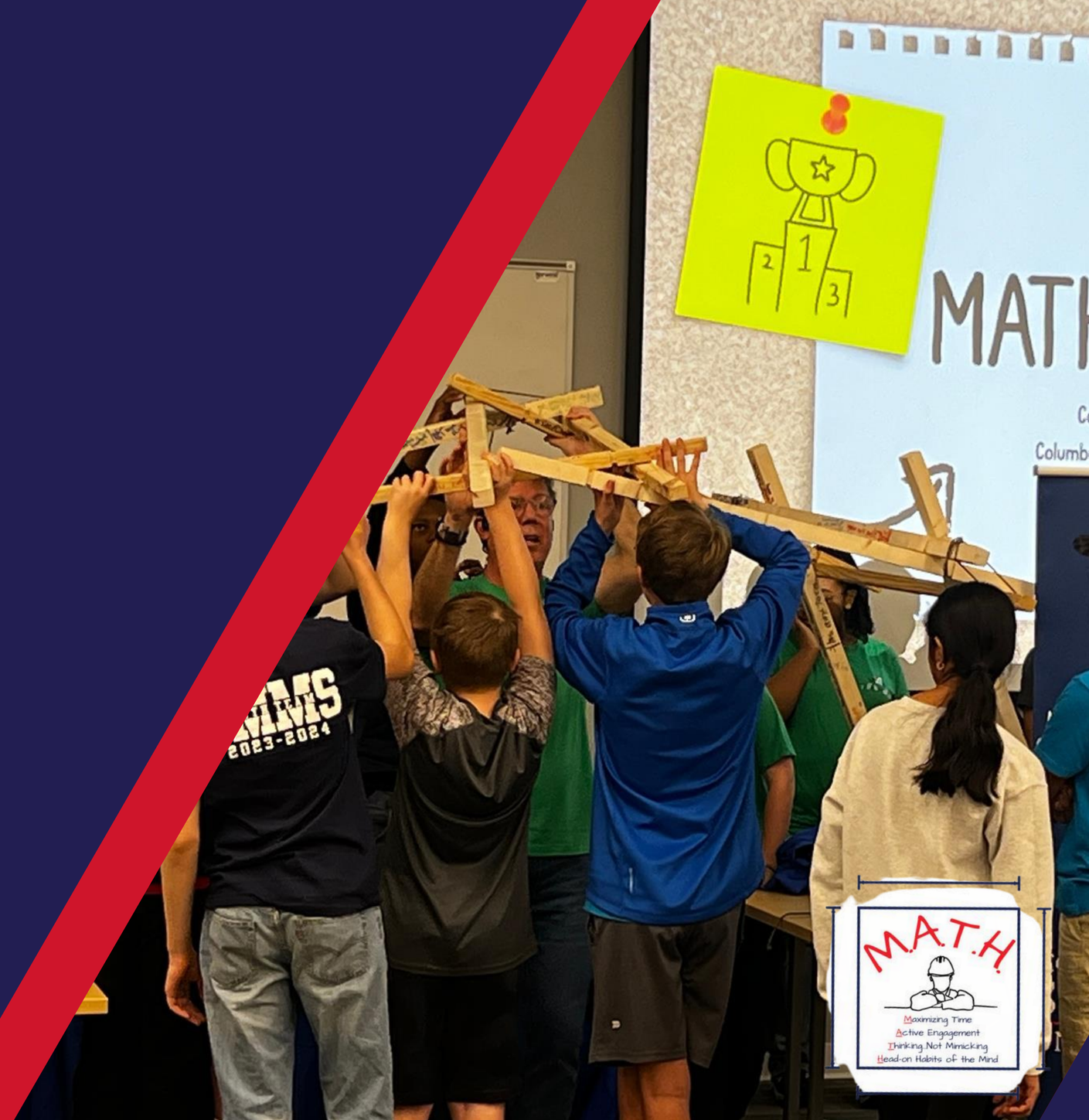
YES! SIGN ME UP!

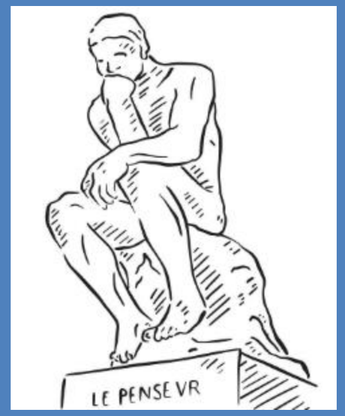
SCAN ME!

THANK YOU

Scan here to stay CONNECTED

Linktree





Thinking Task

“If we want out students to think, we need to give them something to think about” (Liljedahl 19)

Characteristics of a Thinking Task

Thinking tasks create the conditions where students:

- get stuck
- experiment
- might fail
- apply knowledge in new ways (non-routine tasks)
- engage in a cross section of mathematics (or other curricular thinking)

Effective thinking tasks should have:

- Highly engaging problems
- Easy entry points (low floor)
- Evolving complexity (high ceiling)
- Open middle structure - multiple ways of arriving at an answer

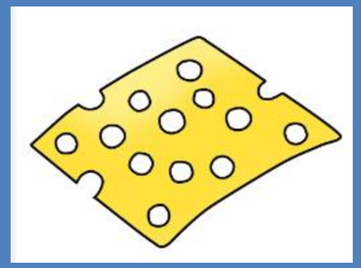
Forming Collaborative Groups

“

follower

thinker

Frequently Visibly Random Groups



Redundancy and Diversity

VRGs

Benefits of visibly random groups:

- Willingness to Collaborate
- Elimination of Social Barriers
- Increased Knowledge Mobility
- Increased Enthusiasm for Learning
- Reduced Social Stress

Summary

Macro Move

- Frequently form visibly random groups

Micro Moves

- Form groups of 3
- Set up your form of randomization such that it tells students where to go
- Find a way to randomize such that the students know that you know what group they are in

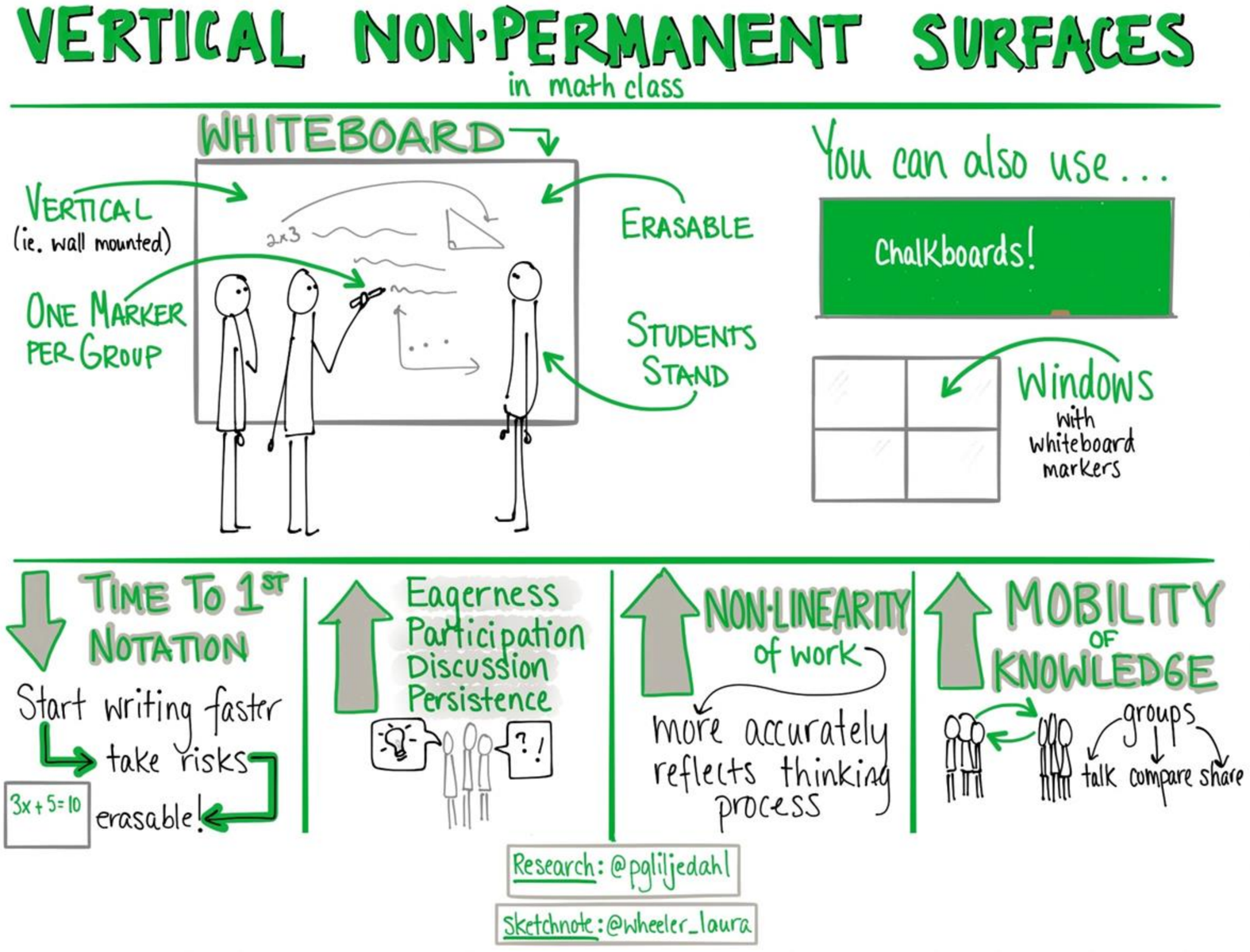
Where do Students work in a Thinking Classroom?

“The continuity of the workspace ensured the continuity of student behaviours”

(Liljedahl 57)

“When students are sitting, they feel anonymous. And when students feel anonymous they are more likely to disengage”
(Liljedahl 57)

Advantages


VERTICAL NON-PERMANENT SURFACES
in math class
WHITEBOARD
VERTICAL
(ie. wall mounted)
ONE MARKER PER GROUP
ERASABLE
STUDENTS STAND
2x3
You can also use...
Chalkboards!
Windows
with whiteboard markers
TIME TO 1ST NOTATION
Start writing faster
take risks
3x + 5 = 10
erasable!
Eagerness
Participation
Discussion
Persistence
?!
NON-LINEARITY of work
more accurately reflects thinking process
MOBILITY OF KNOWLEDGE
groups
talk compare share
Research: @pgliljedahl
Sketchnote: @wheeler_laura

Where Students Work

Students work…

- In groups
- At Vertical Non-Permanent Surfaces
- Standing up
- With shared materials (markers, manipulatives)
- In close proximity to one another

“When students get into their groups and start working on vertical surfaces, the skills they need to be successful are things like communication, perseverance, patience, self-reliance, et cetera”
(Liljedahl 66)

Summary

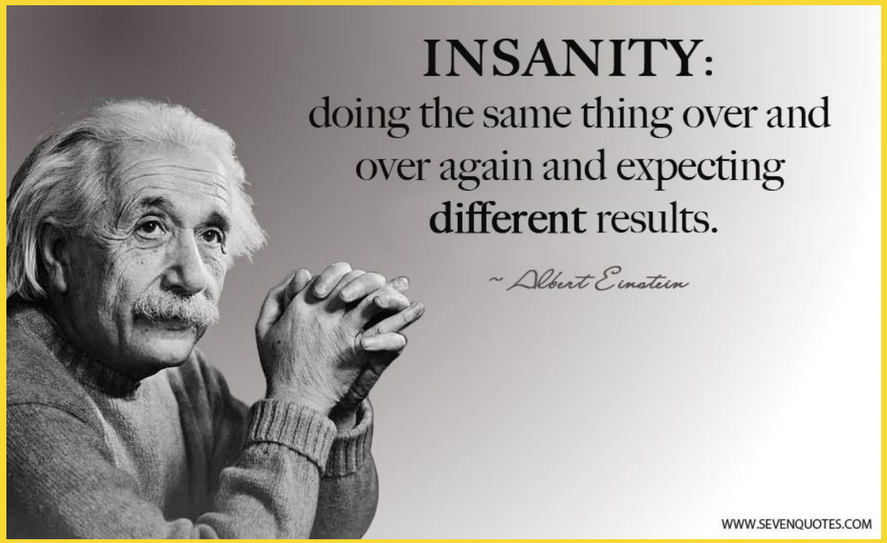
Macro Move

- Use **vertical non-permanent** surfaces

Micro Moves

- Have only **one marker** per group
- **Move the marker** around within the group
- Sometimes have the rule that **the person writing cannot write any of their own ideas**
- Have groups in **close proximity** to each other
- Talk to the students about the **valuing wrong ideas** and not erasing other's work

The Definition of Insanity



Answering Questions in a Thinking Classroom

So Many Questions

Teachers answer between 200 and 400 questions a day!

????????

Does answering all these questions promote thinking?

No!

In fact it is antithetical of the goal of getting students to think.

Types of Questions

- Proximity Questions
- Stop-Thinking Questions
- Keep- Thinking Questions

“Students can be very persistent in their efforts to get you to help them reduce their workload and how you respond to this is important”

(Liljedahl, 89)

Responses

- Isn’t that interesting?
- Can you find something else?
- Can you show me how you did that?
- Is that always true?
- Why do you think that is?
- Are you sure?
- Does that make sense?
- Why don’t you try something else?
- Why don’t you try another one?
- Are you asking me or telling me?

“For students there is a big difference between having their question heard and not answered, and having their question not heard”

(Liljedahl, 91)

Summary

Macro-move

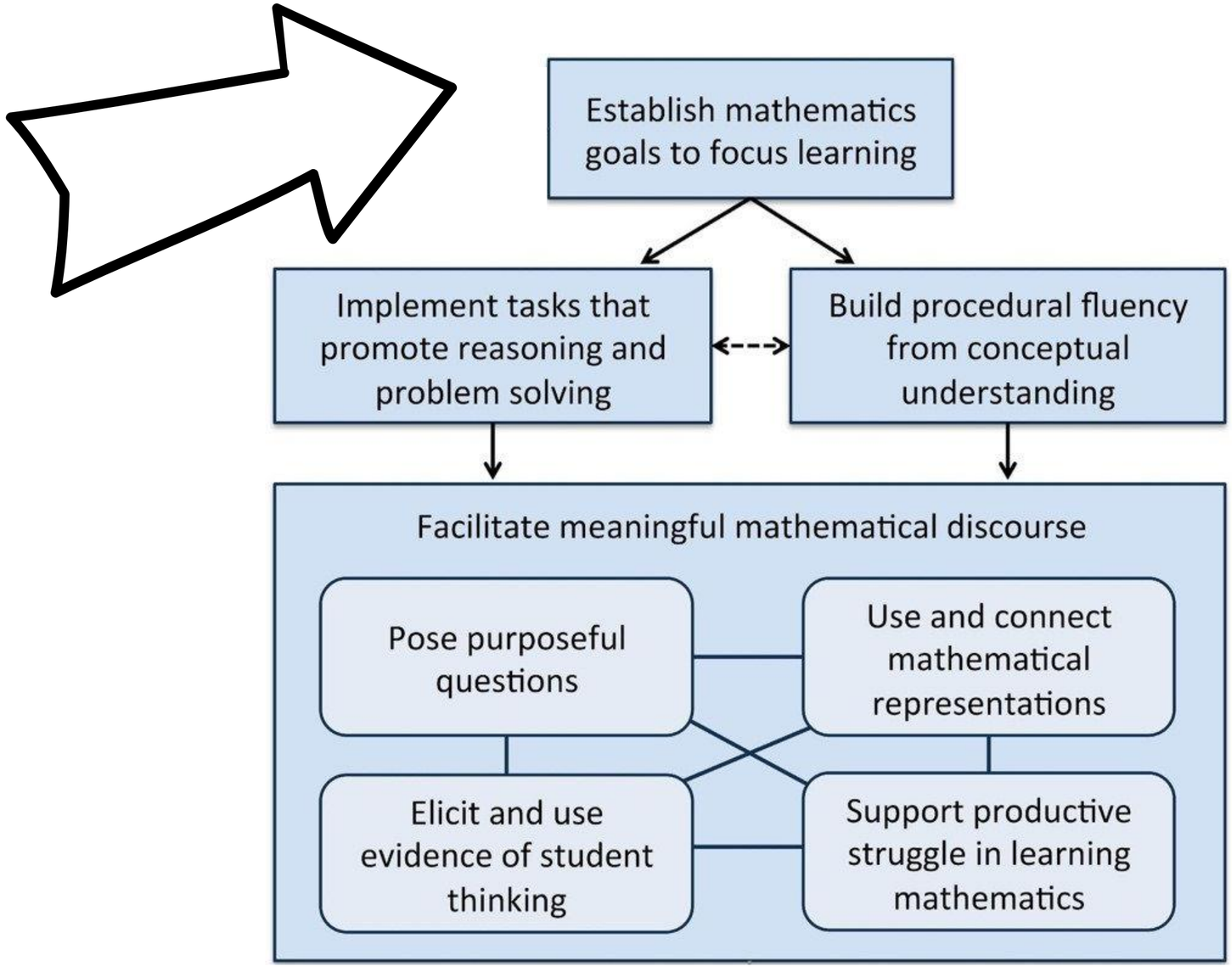
- Answer only keep-thinking questions

Micro-moves

- When asked a proximity or stop-thinking question that you do not want to answer, answer with a question.
- When asked a proximity or stop-thinking question, smile and walk away
- Talk to students about the three types of questions they ask and the types of questions you will answer AFTER you have already implemented the practice

Recommendation #3:
Implement Equitable Mathematics Instruction

- Quality of mathematics learning experiences rather than quantity of problems
- Mathematics is seen as a collaborative endeavor
- Students are asked to solve problems in more than one way
- Students are encouraged to share their thinking, not just solutions


Establish mathematics goals to focus learning
Implement tasks that promote reasoning and problem solving
Build procedural fluency from conceptual understanding
Facilitate meaningful mathematical discourse
Pose purposeful questions
Use and connect mathematical representations
Elicit and use evidence of student thinking
Support productive struggle in learning mathematics