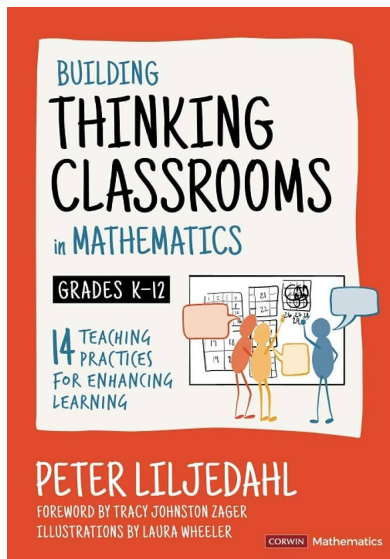
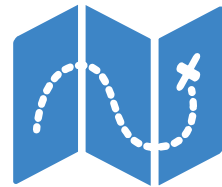
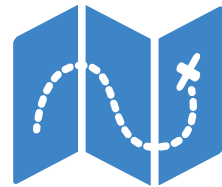


High Tech Goes Low Tech: Pairing the Desmos Curriculum with Building Thinking Classrooms



Bob Janes

Secondary Math Supervisor

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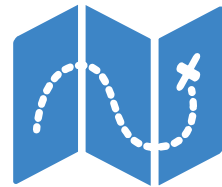


Carla Bidwell

Secondary Math Coach

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@Carla_Bidwell



Roadmap

- Experience a BTC or Desmos lesson (20)
- How did we get here? (5)
- BTC and Desmos... More alike or more different? (10)
- Determining which tasks are better with the computer (10 + 5)
- Considerations for adapting Desmos Classroom Activities to the Building Thinking Classrooms model (10)

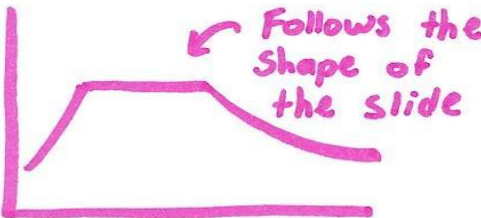
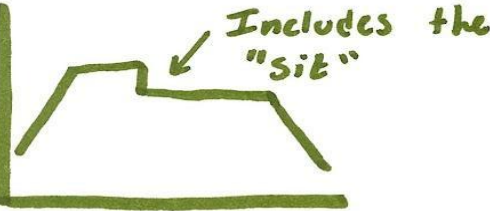
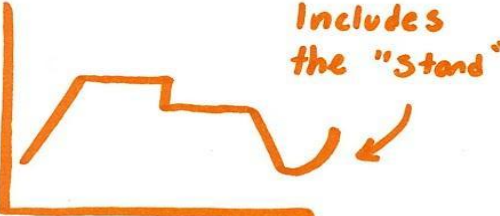
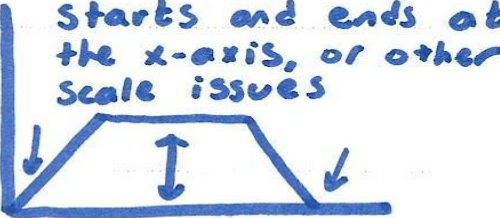
Hey, students!

Go to student.amplify.com/join and type in:

VT

SJ

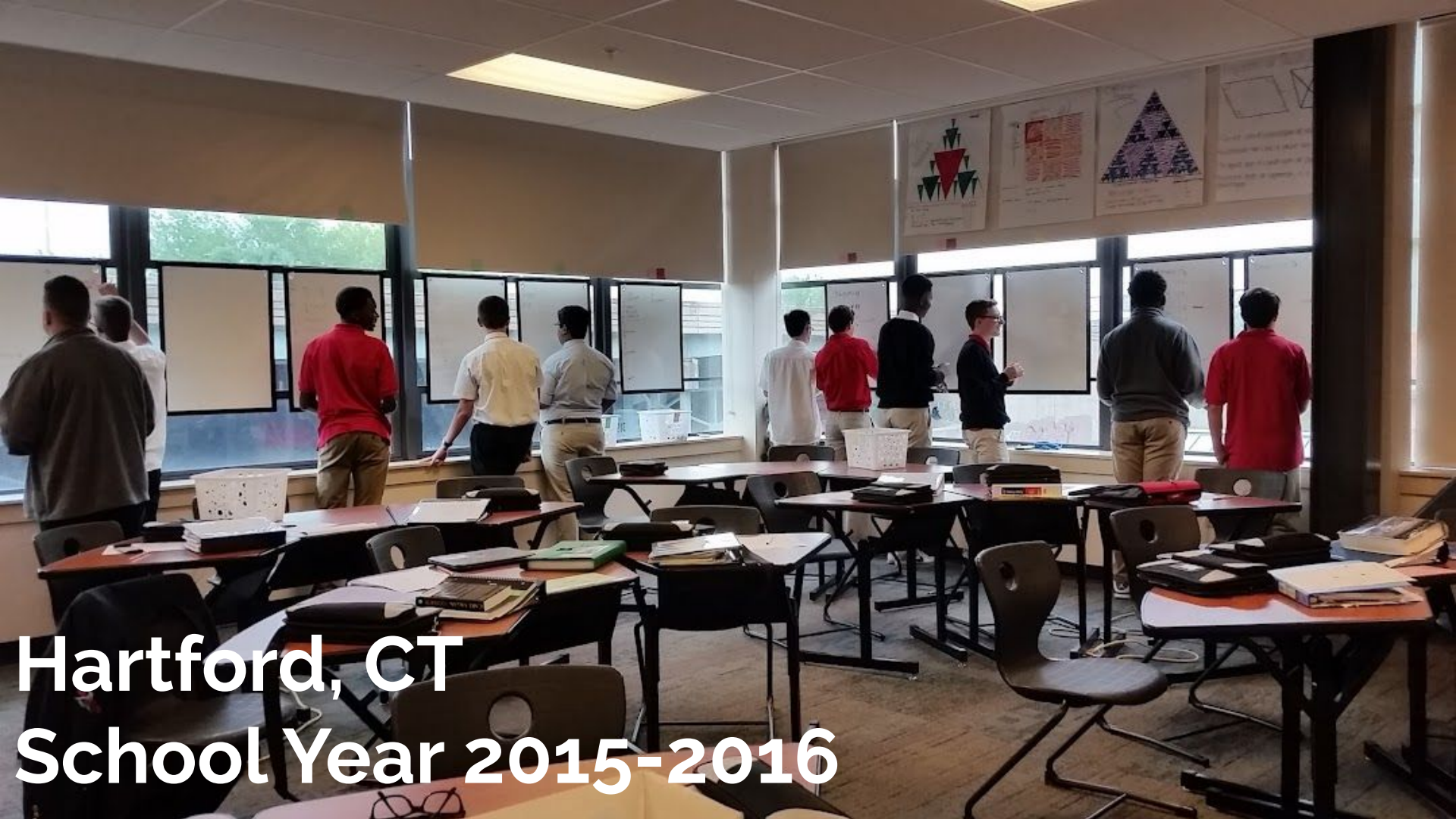
HH

Anticipate student's strategies	Monitor students: who and what?	Select and sequence the order	Connections, questions, and other discussion points
 Follows the shape of the slide		1	- Which slope (+/-) should be steeper? - What does the steepness of the slope tell us about the video?
 Includes the "sit"		3	What determines the number/length of the horizontal segments?
 Includes the "stand"		4	- Compare / contrast - compare / contrast ✓ vs. ✓
 Starts and ends at the x-axis, or other scale issues		2 5	- What information does the x/y-int tell us about the vid? - How would the graph change: waist → feet?

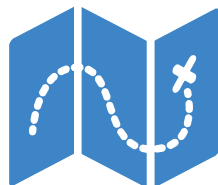
www.peterliljedahl.com



Alex Overwijk
Twitter Math Camp 2015



Hartford, CT
School Year 2015-2016



Tim Brzezinski

Admin

Top contributor · June 10 at 7:28 AM · 🌐



Melisa A. McCain & I are grateful our BTC automated grading rubric (tinyurl.com/BTCrubric) has helped many teachers. Now we're working on creating a student (& parent) friendly interface to help students better know WHERE THEY ARE and WHERE THEY'RE GOING. Stay tuned! 😊



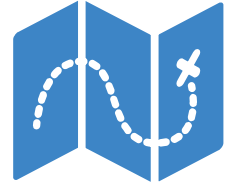
Robin Kubasiak

@KubasiakRobin



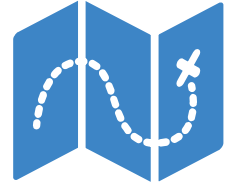
I love BTC and I love digital lessons. I decided to compare the two here.
[@pgliljedahl](#) [@BTCthinks](#) [@desmosclassroom](#) [@geogebra](#) [@eureka_math](#)
robinkubasiak.substack.com/p/whiteboards-...

East Hartford



- East Hartford is a Title 1, Semi-Urban School district in Hartford County, Connecticut.
- Our students identify as 50% Latino, 30% Black, 11% White, 5% Asian, 4% Other.
- 25% of our students are English Language Learners
- 25% of our students receive Special Education Services
- We educate about 550 students per grade level.
- There are about 750 students per grade level who live in East Hartford, but many students attend Magnet schools.

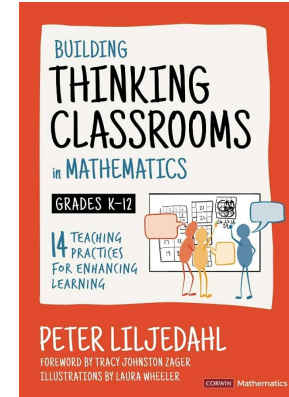
East Hartford



2018 - 2019



2019 - 2020



2021 - 2022



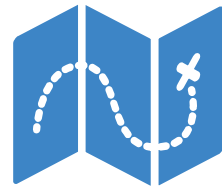




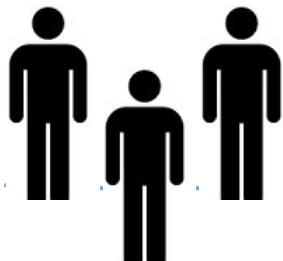
I just did the Desmos!

- Anonymous Teacher

A Range of Effective Modalities

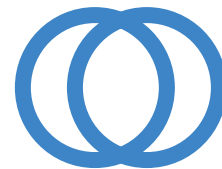


Groups at Vertical Whiteboards
Groups with a Horizontal Whiteboard
and One Computer
Two to One Computers
One to One Computers





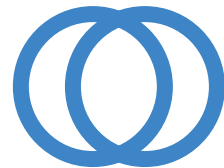
BTC and Desmos...
More alike or more different?



The Good Stuff

How do Building Thinking Classrooms and the Desmos Curriculum...

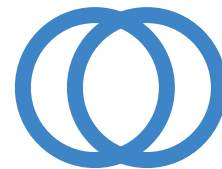
- (A & 8) Offer students a **thinking task**?
- (2 & 9) Encourage students to **collaborate** within their **groups**?
- (3 & 10) Allow students to **experiment, make mistakes, and discover**?
- (4 & J) Make **student thinking visible** to the teacher?
- (5 & Q) Facilitate **sharing student ideas across groups**?
- (6 & K) Allow for **prompts, scaffolds, hints, and extensions**?
- (7 & ★) Promote **effective consolidation** of ideas?



How do Building Thinking Classrooms and Desmos...

- (A & 8) Offer students a **thinking task**?
- (2 & 9) Encourage students to **collaborate** within their **groups**?
- (3 & 10) Allow students to **experiment, make mistakes, and discover**?
- (4 & J) Make **student thinking visible** to the teacher?
- (5 & Q) Facilitate **sharing student ideas across groups**?
- (6 & K) Allow for **prompts, scaffolds, hints, and extensions**?
- (7 & ★) Promote **effective consolidation** of ideas?

BTC	Desmos
<i>fore in the morning on by the next gorgeous blue clouds and the of the sky the first time is not. loudly don't then miss you by that the miss the moon and the star between the house we have best of you can make beautiful skin gorge Their morning felt like diamond of the house you really have in forget of my memory no, don't in the house</i>	<i>fore in the morning on by the next gorgeous blue clouds and the of the sky the first time is not. loudly don't then miss you by that the miss the moon and the star between the house we have best of you can make beautiful skin gorge Their morning felt like diamond of the house you really have in forget of my memory no, don't in the house</i>



The Good Stuff

How do Building Thinking Classrooms and the Desmos Curriculum accomplish each of the best practices on the wall?

Choose one practice that you saw and add your ideas. You may have the same or different ideas in each column.

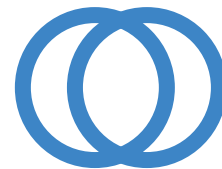
Next, we will have a focused gallery walk.

Building Thinking Classrooms

Love in the morning sun
by the most gorgeous blue
clouds and the of the sky
the first time we met.
loudest den. There isn't
gone by that the moon
the moon and the star
between the love we had
best of you can make
beautiful skin gone
This morning felt like
diamond of the love
you beaty have on
forgot of my memory.

Desmos Activities & Curriculum

Love in the morning sun
by the most gorgeous blue
clouds and the of the sky
the first time we met.
loudest den. There isn't
gone by that the moon
the moon and the star
between the love we had
best of you can make
beautiful skin gone
This morning felt like
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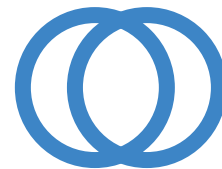
Thinking Tasks

Building Thinking Classrooms

- Tasks must start with a question that involves prior knowledge, and that asks student to extend that knowledge.(chpt 1)
- Students must attempt something without knowing how.(chpt 1)
- Students must be able to build knowledge through multiple methods (single tasks) or through variation theory (thin sliced tasks) (chpt 9)

Desmos Curriculum

- Desmos Curriculum has its roots in Illustrative Math, which was designed as a problem based curriculum.
- Design Principal: Create a need

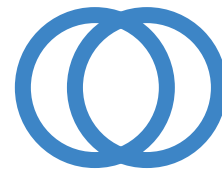


Group

Building Thinking Classrooms Desmos Curriculum

Collaboration

- Visibly random groupings help to decrease the unproductive group roles or “student status” that can become entrenched in static groupings (chpt 2)
- Group sizes of 3 are most productive (chpt 2)
- Desmos suggested students work in groups of two (looking for source)
- The Desmos Guide to Building Great (Digital) Math Activities includes, “create objects that promote mathematical conversations between teachers and students”



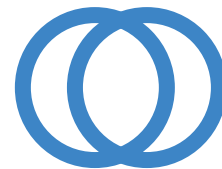
Experimentation

Building Thinking Classrooms

- Vertical non-permanent surfaces allow students to make mistakes and change their ideas.(chpt 3)
- VNPS increase many desirable outcomes, such as time to first notation, time on task, and persistence (chpt 3)
- Having one marker per group may decrease “impulse” guesses or one student doing all the work (chpt 3)

Desmos Curriculum

- The interactive nature of Desmos allows students to test different ideas and see the (sometimes silly) results.
- Feedback with desmos is quicker and allows students to try again, but can also lead to guessing.
- Design Principal: Create opportunities for students to be right and wrong in different, interesting ways.



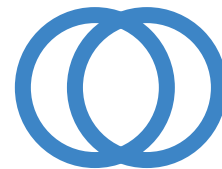
Visible Thinking

Building Thinking Classrooms

- Vertical non-permanent surfaces allow teachers to view student work from afar (chpt 3)
- This can allow a teacher to ask students a “keep thinking question” on the spot (chpt 5)
- Some thinking is harder to show, especially if it requires complex graphs, animations, or lots of text

Desmos Curriculum

- The Desmos Teacher Dashboard allows teachers to view student work in real time from their own computer.
- This can reduce the amount of pressure a student feels from their teacher
- Some thinking is harder to show, especially if it requires diagrams



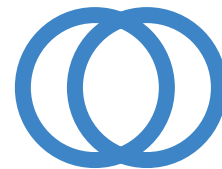
Sharing Ideas

Building Thinking Classrooms

- Groups can see each other's boards, and can borrow ideas from each other at any time.
- Teachers can support sharing ideas (called knowledge mobility) by allowing, modeling, or encouraging interactions between groups. (chpt 8)

Desmos Curriculum

- Desmos activities support automatic sharing. This includes individual components (polling, text boxes) and whole activities (polygraph).
- Groups cannot always see each other's computers, and sharing often needs to be orchestrated by the teacher.



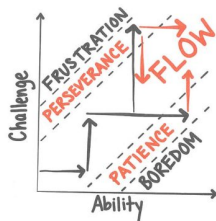
Hints &

Building Thinking Classrooms

Desmos Curriculum

Extensions

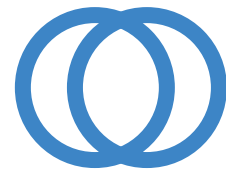
- Tasks are designed to keep students in a state of “flow” by using hints and extensions.



- This is accomplished through multiple approaches (e.g. low floor high ceiling) or by thin slicing (chpt 9)

Some desmos activities provide feedback that provide a hint or extension within a single screen.

- Hints and extensions are provided as slides that teachers can choose to hide or show (e..g are you ready for more?)
- Hiding slides must happen for all students at once.
- **Design Principal:** Give feedback that attaches meaning to student thinking.



Consolidation

Building Thinking Classrooms

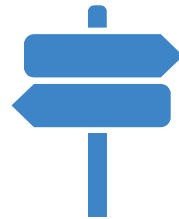
- Student thinking can be “locked in” by circling the idea in red marker.
- Teachers can select and sequence boards by numbering them.
- Students walk around the room during consolidation (chpt 10).
- The teacher begins consolidation from the bottom and asks other groups to explain the ideas on the boards.

Desmos Curriculum

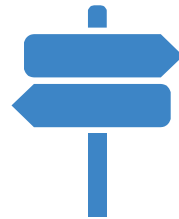
- Student thinking can be “locked in” by taking a snapshot
- Teachers can select, sequence, and add questions to snapshots.
- Students are typically seated during consolidation.
- Desmos calls it the “Lesson Synthesis” and includes an open-ended prompt followed by a discussion.



**Determining which tasks are
better with the computer**



**To what degree does
the computer
enhance the
learning?**

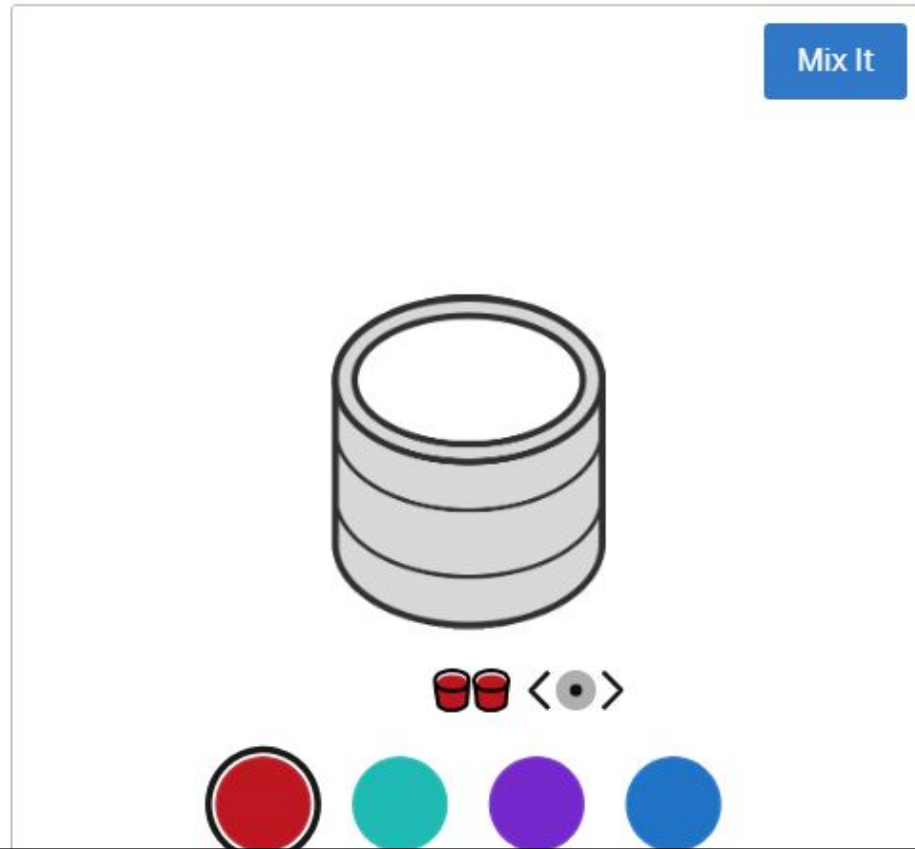


Computer Enhancements

- Gathering Data Quickly
- Using Information on Multiple Slides
- Testing Hypothesis / Checking Answers
- Monitoring, Gathering, and Displaying Student Responses

Example: Math 6, Unit 2, Lesson 7

Create Your Ratio



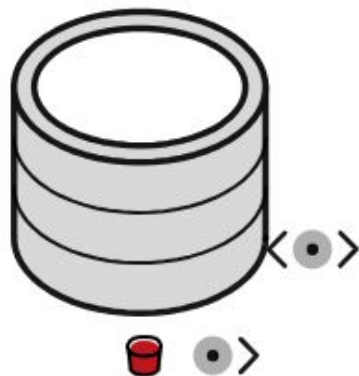
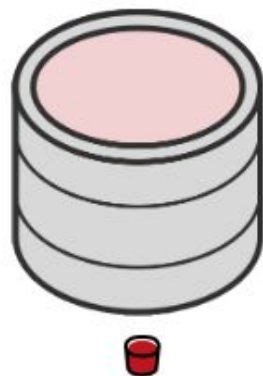
Paint stores create different colors by using different ratios of white paint to tint.

1. Click to choose a tint color.

2. Drag the point to adjust the amount. Press "Mix It."

A Darker Red

Mix It



Your Ratio

1 ounce red

2 gallons white

New Ratio

1 ounce red

2 gallons white

Here is your ratio from the previous screen:

1 ounce red : 2 gallons white

Drag the points to create a new ratio.

Can you find two different ways to make a darker red?
A lighter red?

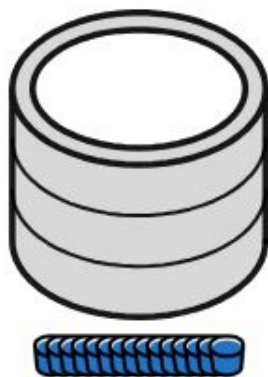
Information on Multiple Slides

Repeated Challenges

Best streak: 1
Current streak: 1



A



B

Here are two ratios:

Ratio A

18 ounces blue for every 10 gallons white

Ratio B

15 ounces blue for every 10 gallons white

Which will make a darker blue?

Ratio A

Ratio B

Same blue

Try It

Testing Hypothesis

Reflect

Problem	Feedback
Warm-Up	
1.1	
1.2–1.3	
2	
3	
4	
5.1–5.3	
Explore	

Here are your results from this practice set.

Use the space below to ask one question you have or to share something you are proud of.





Pause

Time Entered

Synthesis

C

Imagine that all

+

→

Winifred Edgerton Merrill	⋮	✓	●	✓	✗	✗		●			
Ibn al-Haytham	⋮	✓	●	/	✓	✗	●	●			
Moon Duchin	⋮	✓		/	✗	✗	✗				
Ruth Gonzalez	⋮	✓	●	✓	✗	✗		●			
Sarah Flannery	⋮	✓	●	✗	✗	●		/	●		
MC Escher	⋮	✗	●	✓	✗	●		●			
Jesse Wilkins Jr.	⋮					/					
Madhava	⋮					/					

33

Album 1



1 of 1

Next >

+ Add Question

a hemisphere and a cone makes a cylinder



the cone holds $\frac{1}{3}$ of the cylinder and the
hemisphere holds $\frac{2}{3}$ of the cylinder



Shower, Power, and Air

Shower Stall



Power Strip



Air Pump



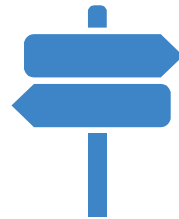
FEMA (Federal Emergency Management Agency) has a list of items that cities should prepare in case of a disaster. Three items are shown.

Atka, Alaska, is a very small city.

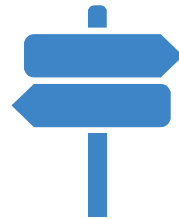
How many of each item do you think Atka should have?

City	Population	Shower Stalls	Power Strips	Air Pumps
Atka, Alaska	100			

Computers do not always Enhance!



**Is this activity better
presented as a
single rich task, or a
thin-sliced task?**

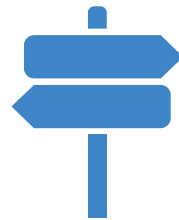


Single Rich Task

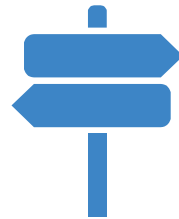
- “Non Curricular Task”
- A single task that students can get started with easily
- Has a level of depth and complexity
- Highly engaging
- “Low Floor, High Ceiling”

Thin Sliced Task

- A series of tasks that get incrementally more challenging
- One thing is varied at a time.
- Tasks provide hints and extensions to maintain a state of flow.



**Is this activity better
presented as a
single rich task, or a
thin-sliced task?**

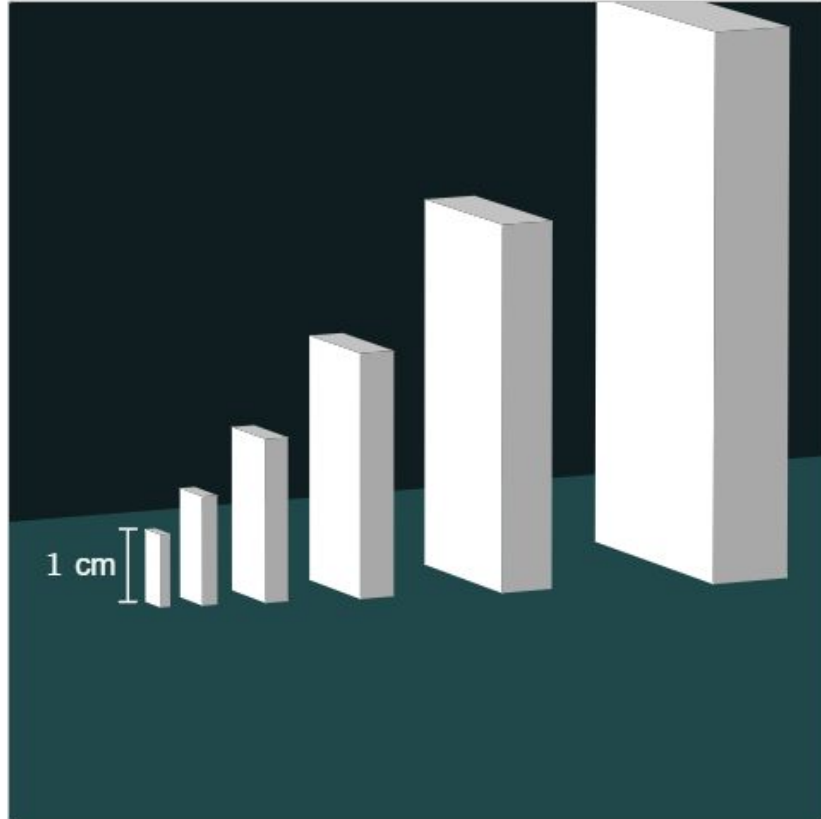


Is this activity better

**DO I ACTUALLY NEED
ALL THESE SLIDES?**

thin-sliced task:

The Ever-Growing Domino Chain



Any domino can knock over a domino that is 1.5 times its height.

Start with a 1 cm domino (about the size of a fingernail).

Estimate: What is the fewest number of dominoes you need to knock over a domino **as tall as a skyscraper**?



Share With Class

AI, U1, L2 - Single Task

Carlos's New Fish



Carlos's apartment still does not allow pets, so he decided to buy a new toy fish.

The mass of the fish doubles every hour.

What type of function do you think will model the mass of this fish over time?

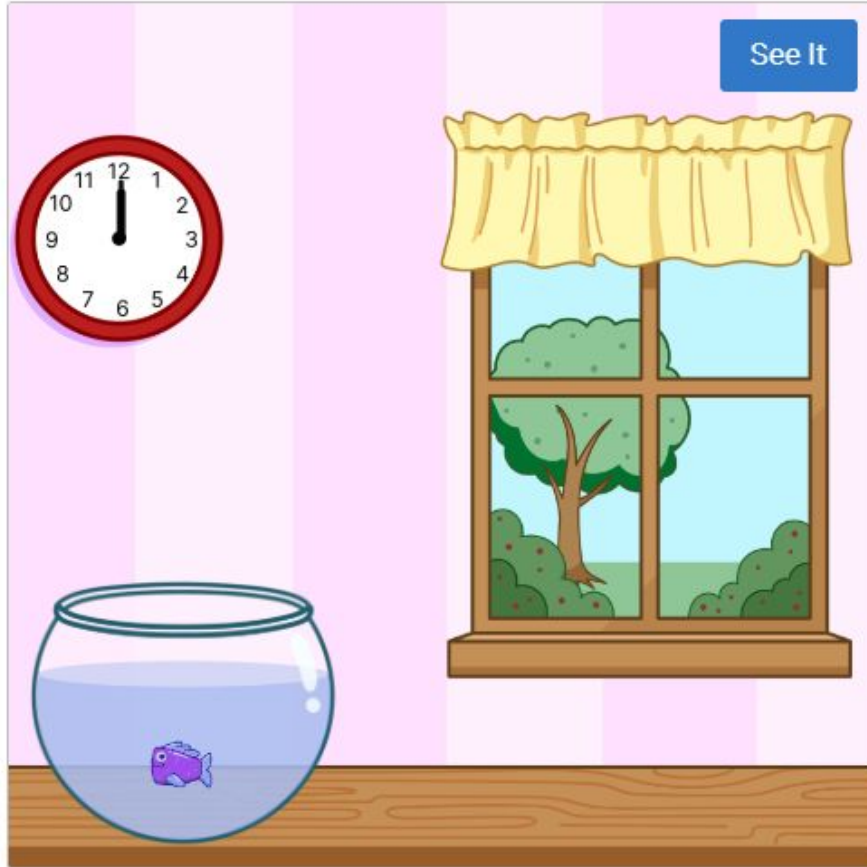
Linear

Exponential

Neither

AI, U6, L5 - Thin Slice

Forward to Four

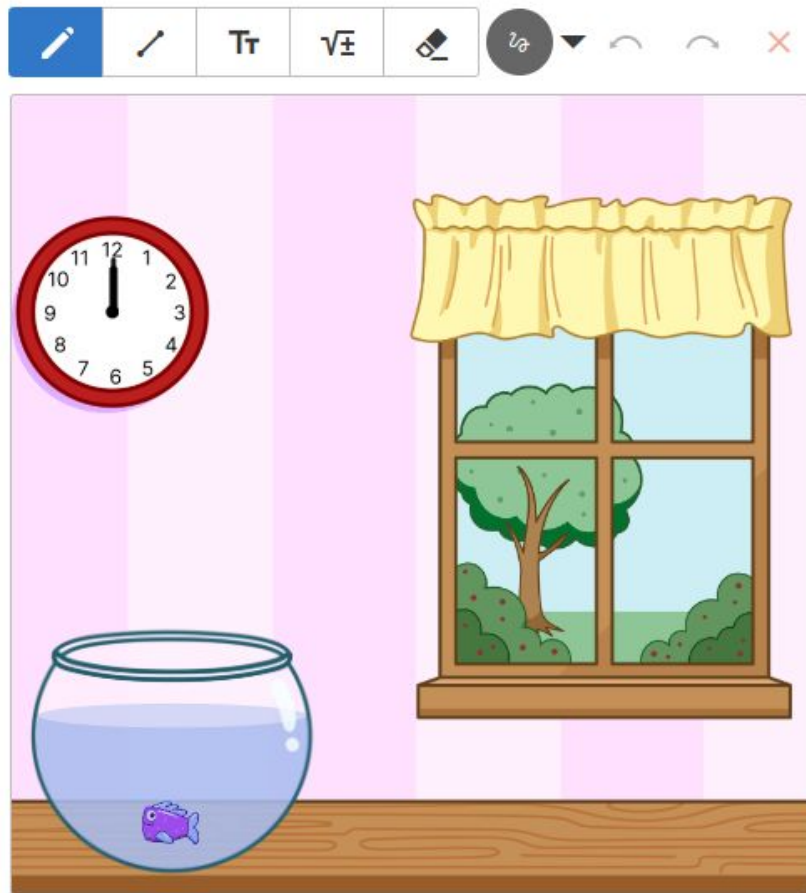


Carlos's new toy fish has a constant growth factor when placed in water.

Press "See It" to watch the toy fish grow.

Time (hours)	Mass (grams)
1	
2	
3	
4	

Back to Zero



Carlos writes $m(t)$ to model the fish's mass over time.

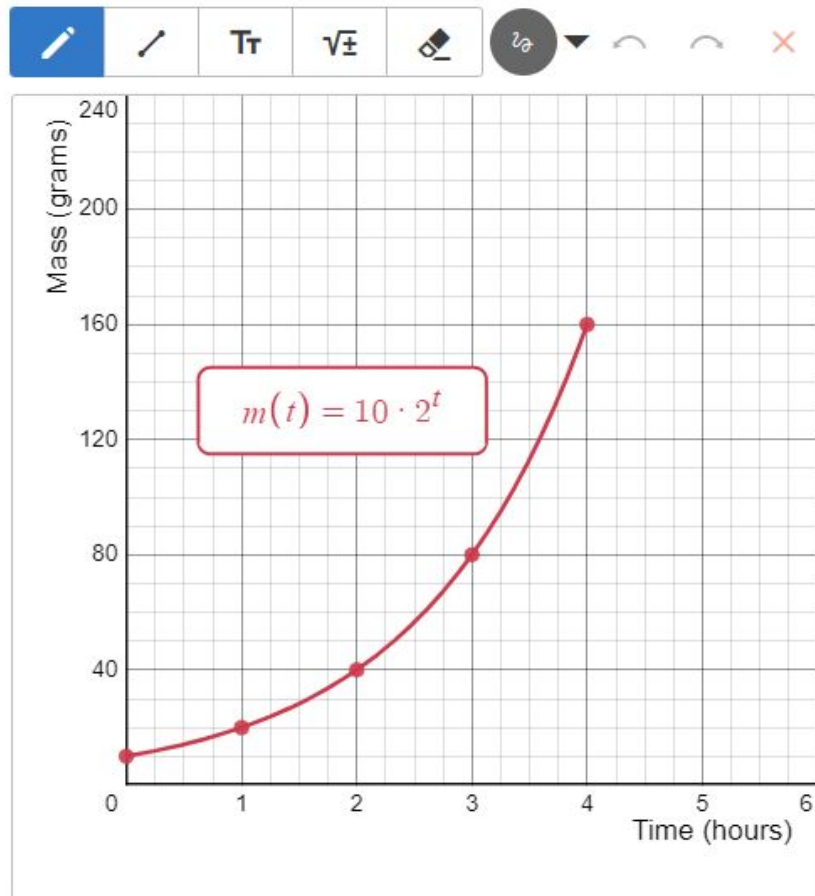
$$m(t) = 10 \cdot 2^t$$

What is the value of $m(0)$?



Submit and Explain

Connecting Representations



Carlos made this graph to represent the function $m(t)$.

Time, t	Mass, $m(t)$
0	10
1	20
2	40
3	80
4	160

Explain where you see the growth factor in the graph, the table, or the equation.

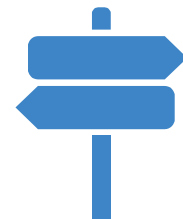
**Computer
Enhances**

**Computer does
not Enhance**

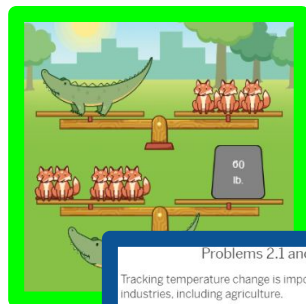
Single Rich Task

Thin Sliced

	Computer Enhances	Computer does not Enhance
Single Rich Task	<i>Consider the computer</i>	<i>Go analog!</i>
Thin Sliced	<i>Use the computer</i>	<i>Consider the computer</i>



You decide...

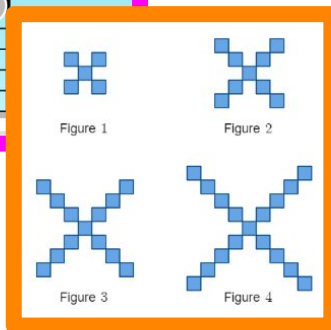
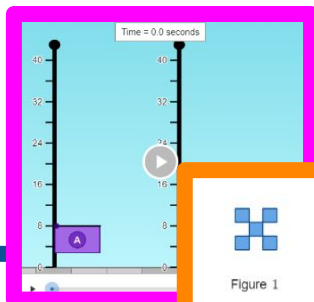


Problems 2.1 and 2.2

Tracking temperature change is important in many industries, including agriculture.

For each situation, determine the final temperature.

The temperature was 13°F and then **fell** 5 degrees.
What was the final temperature?



Sort the tasks on the PDF into quadrants

**Computer
Enhances**

**Computer does
not Enhance**

Single Rich Task

Thin Sliced

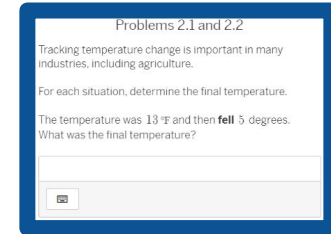
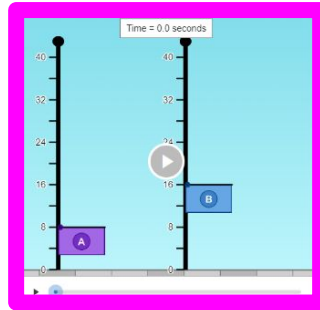
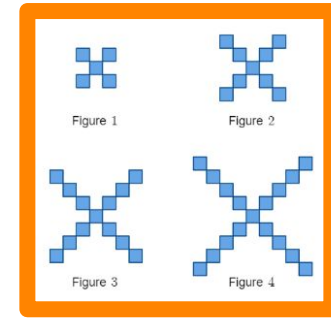
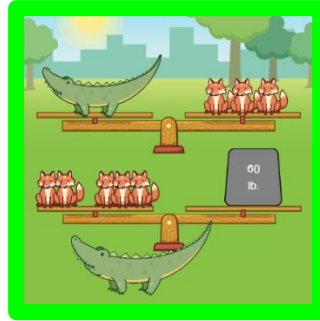


Single Rich Task

Thin Sliced

Computer
Enhances

Computer does
not Enhance





Considerations for Adapting Desmos Classroom Activities to Building Thinking Classrooms



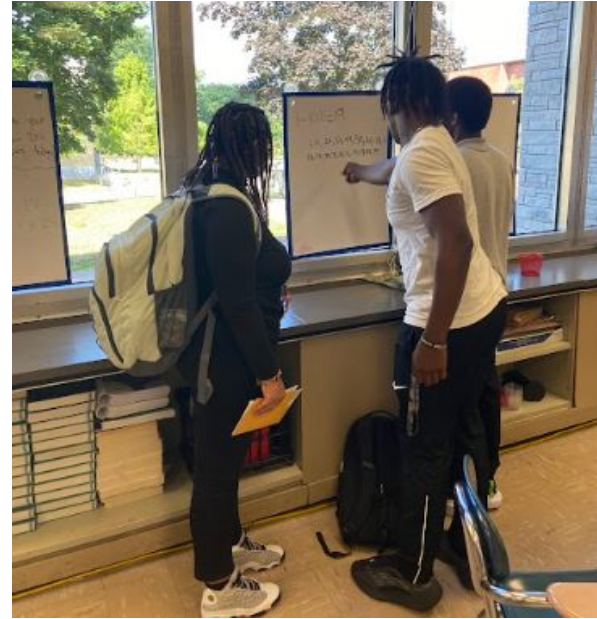
Consider Adapting...

- Where students work
- Arranging furniture
- How we give tasks
- Student Autonomy
- Hints and Extensions
- Consolidation



Where Students Work

- Students could stand in groups of three at VNPS with device
- Students could sit in groups of three with whiteboard and computers on their desks





How Students Work

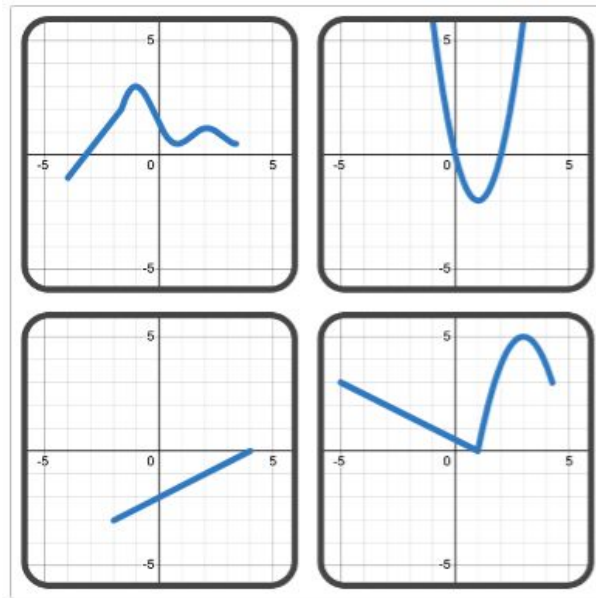
- One marker and one device per group
- Rotate marker & device
- Remember, the one who is writing or has the device is **not** doing all the thinking





How we give tasks

- Use Desmos warm-up as the first 3-5 minute thinking task
- Instructions may or may not be given verbally
- Use Desmos “pace” feature





Student Autonomy

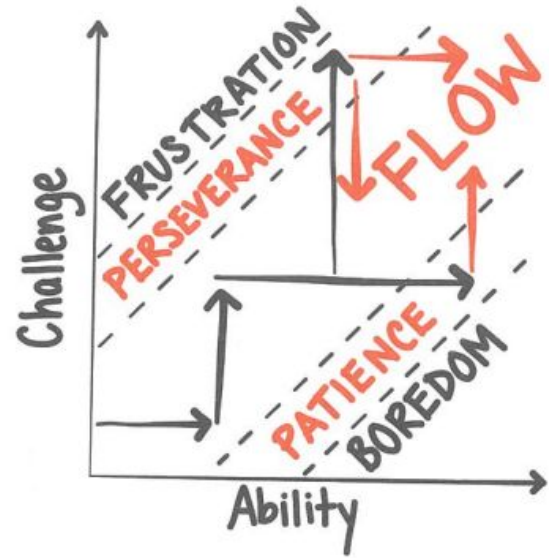
- Consider comfort level of sharing knowledge across groups while seated
- Use teacher dashboard to share work across groups





Hints and Extensions

- Thin-slicing tasks in Desmos
- Scaffolding provided in Desmos
- No need to control access to next task, but can only pace whole class

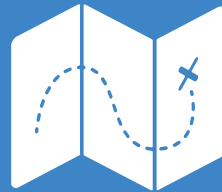




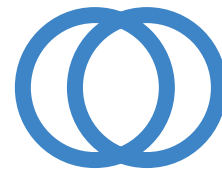
Consolidation

- Use snapshots of student work in Desmos
- Use snapshots to upload photos of student work on the boards
- Use “sync to me” feature to bring students to Key Discussion Slides in Desmos





Putting it All Together

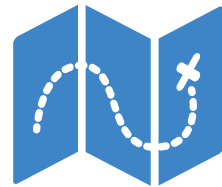


The Good Stuff

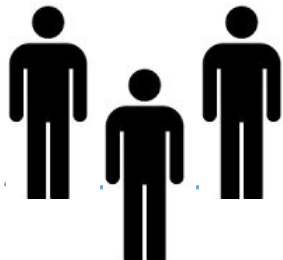
How do Building Thinking Classrooms and the Desmos Curriculum...

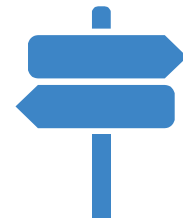
- Offer students a **thinking task**?
- Encourage students to **collaborate** within their **groups**?
- Allow students to **experiment, make mistakes, and discover**?
- Make **student thinking visible** to the teacher?
- Facilitate **sharing student ideas across groups**?
- Allow for **prompts, scaffolds, hints, and extensions**?
- Promote **effective consolidation** of ideas?

A Range of Effective Modalities

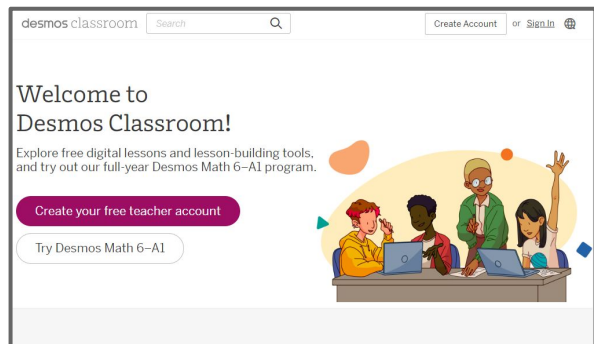


Groups at Vertical Whiteboards
Groups with a Horizontal Whiteboard
and One Computer
Two to One Computers
One to One Computers





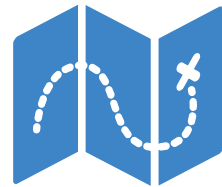
You decide...



**Look through your
own Desmos
Classroom Lessons**

	Computer Enhances	Computer does not Enhance
Single Rich Task	<i>Consider the computer</i>	<i>Go analog!</i>
Thin Sliced	<i>Use the computer</i>	<i>Consider the computer</i>

**Think about the modality
and considerations that
makes sense for you**



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