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Ditch That Lecture

Designing Activities For Abstract Topics That Foster Inquiry

Jim Pardun
@JimPa23

Session #482
Friday, 3pm


EXIT

“How do you incorporate this strategy into topics such as polynomial multiplication? PLEASE ANSWER THIS ONE!”

Dan Meyer
@ddmeyer

Following

Problem solving workshop Q: "How do you incorporate this strategy into topics such as polynomial multiplication? PLEASE ANSWER THIS ONE!"

1:42 PM - 12 Apr 2013

2 Likes

9 2

Tweet your reply

Jonathan
@rawrdimus

INFINITE SUMS

MAIN ALG II PRE CAL CALCULUS ABOUT ME PHOTOS ARCHIVE E-MAIL @RAWRDIMUS

I've seen it in our Algebra II textbook as well. My first year I think I put something like this on an assignment when I was going to have a sub. Naturally, no one figured it out or found it amazing. The whole point is to attach some meaning to the pixelated graph of a polynomial and teach something about maximums. Coincidentally, I saw this a few weeks ago:

> Problem solving workshop Q: "How do you incorporate this strategy into topics such as polynomial multiplication?PLEASE ANSWER THIS ONE!"
>
> — Dan Meyer (@ddmeyer) April 12, 2013

I don't know and did not pursue more context to this, but I assume the thought was how do you jazz up something bland and skill based like polynomial multiplication. I remembered that in


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Could use thatRT @rachelrosales: Looking for a good real-world application of radical equations & rational exponents. HELP. #MTBOS #alg2chat
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Katrina Newe
@MrsNewellsMat
Looking for
world and
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#Instructio
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ctivity,
the

“You’re about to hear a lecture on how to not lecture.”

Fostering Inquiry - 5 Things To Know

1.

2.

3.

4.

5.

Definitions

- **Inquiry** - The natural curiosity that lies within all of us.
- **Inquiry/Problem Based Learning** - A student-centered pedagogy where a specific set of problems / activities are used to trigger curiosity within students.
- **Project Based Learning** - A student-centered pedagogy where students develop a deeper knowledge by working for an extended period of time to investigate a complex question, problem, or challenge.

Fostering Inquiry - 5 Things To Know

1.

2.

3.

4.

5.

Fostering Inquiry - 5 Things To Know

1. Group Norms

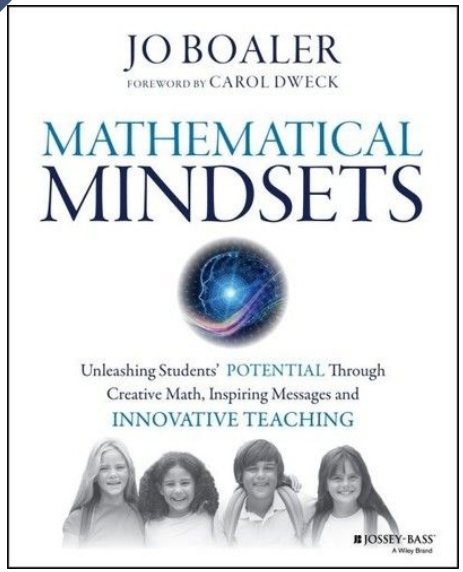
2.

3.

4.

5.

1. Establish Group Norms



Everyone can learn math to the highest levels.

Mistakes are valuable.

Questions are really important.

Math is about creativity & making sense.

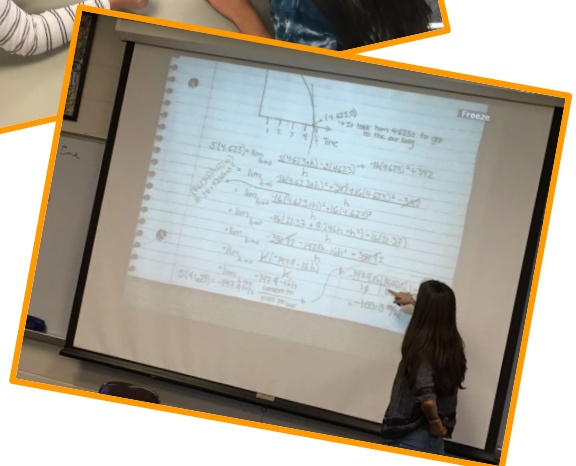
Math is about connections & communicating.

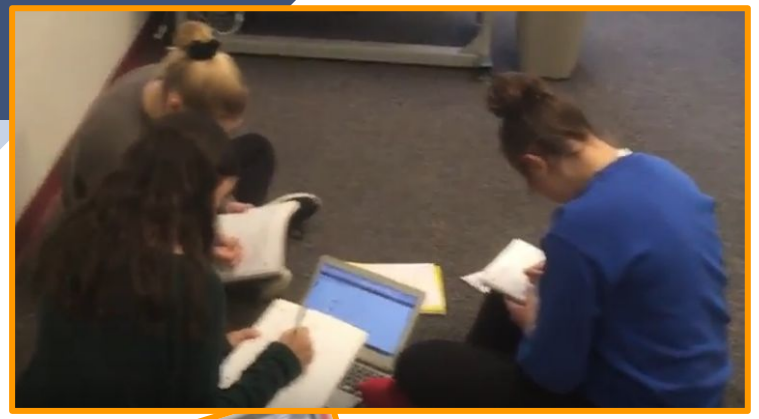
Math class is about learning not performing.

Depth is more important than speed.

Source: Mathematical Mindsets by Jo Boaler

1. Establish Group Norms





Fostering Inquiry - 5 Things To Know

1. Group Norms

2.

3.

4.

5.

Fostering Inquiry - 5 Things To Know

1. Group Norms

2. Goals

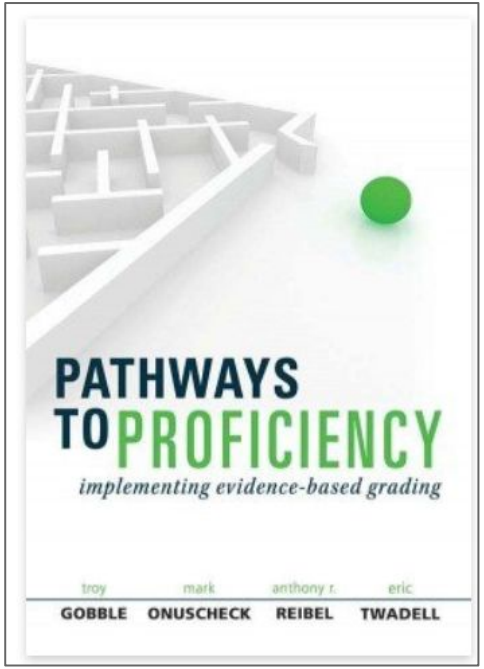
3.

4.

5.

2. Goals - Where Are You Going?

- Learning Targets
  - What skill am I expected to perform?
  - Why do I need to perform this skill?
  - How well do I need to perform this skill?
- How will students demonstrate their learning?
- What will assessment look like?



Fostering Inquiry - 5 Things To Know

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Fostering Inquiry - 5 Things To Know

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2. Goals

3. Prior Knowledge

4.

5.

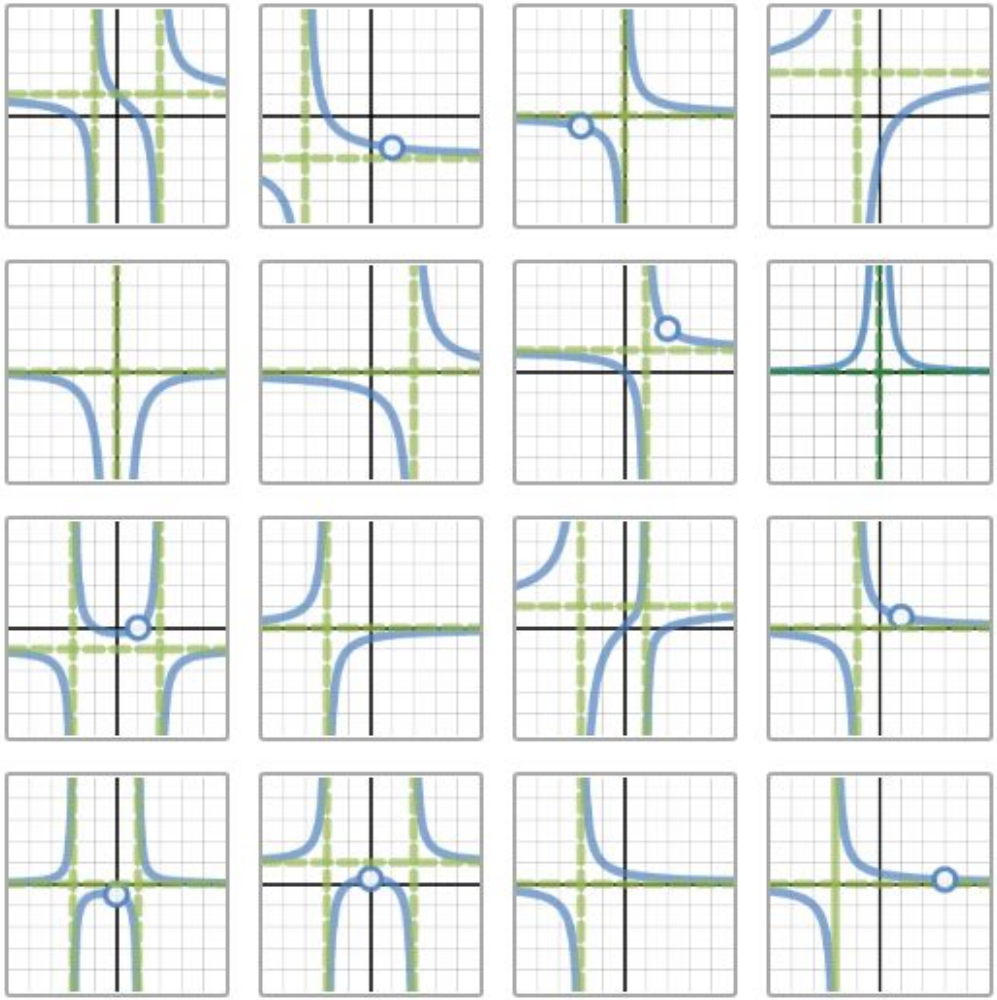
3. Tap Into Prior Knowledge

- Preview Activities
  - Immediate engagement
  - Foreshadow upcoming ideas
  - Worked individually by the student
  - Primes the brain for what happens next

Source: Active Calculus by Matthew Boelkins

3. Tap Into Prior Knowledge

- Polygraph by Desmos



Questions Asked: 0

Your Partner: Jim Pardun

Yes / No Questions

What would your first question be?

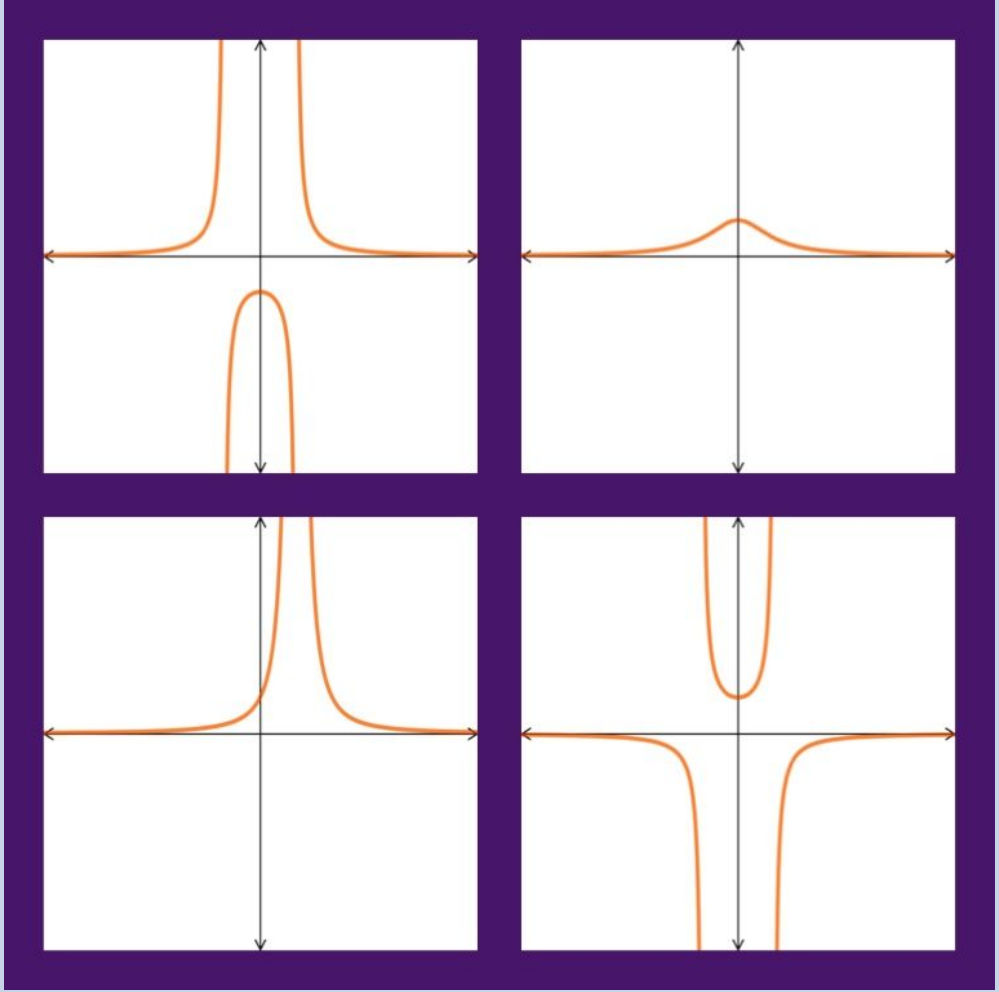
Your challenge: figure out which graph your partner picked. Ask a "yes" or "no" question about the graph.

Send

3. Tap Into Prior Knowledge

- Polygraph by Desmos
- Which One Doesn't Belong (WODB)

Decide which one doesn't belong?



Tell the person sitting next to you.

Source: WODB.ca by Mary Bourassa

3. Tap Into Prior Knowledge

- Polygraph by Desmos
- Which One Doesn't Belong (WODB)
- Preview Activity - Product & Quotient Rules for Derivatives

2.3 The product and quotient rules

Preview Activity 2.3. Let u and v be the functions defined by $u(t) = 2t^2$ and $v(t) = t^3 + 4t$.

(a) Determine $u'(t)$ and $v'(t)$.

(b) Let $p(t) = 2t^2(t^3 + 4t)$ and observe that $p(t) = u(t) \cdot v(t)$. Rewrite the formula for p by distributing the $2t^2$ term. Then, compute $p'(t)$ using the sum and constant multiple rules.

(c) True or false: $p'(t) = u'(t) \cdot v'(t)$.

(d) Let $q(t) = \dfrac{t^3 + 4t}{2t^2}$ and observe that $q(t) = \dfrac{v(t)}{u(t)}$. Rewrite the formula for q by dividing each term in the numerator by the denominator and simplify to write q as a sum of constant multiples of powers of t. Then, compute $q'(t)$ using the sum and constant multiple rules.

(e) True or false: $q'(t) = \dfrac{v'(t)}{u'(t)}$.

Source: Active Calculus by Matthew Boelkins

3. Tap Into Prior Knowledge

- Polygraph by Desmos
- Which One Doesn't Belong (WODB)
- Preview Activity - Product & Quotient Rules for Derivatives
- Preview Activity - Polynomial Functions

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Fostering Inquiry - 5 Things To Know

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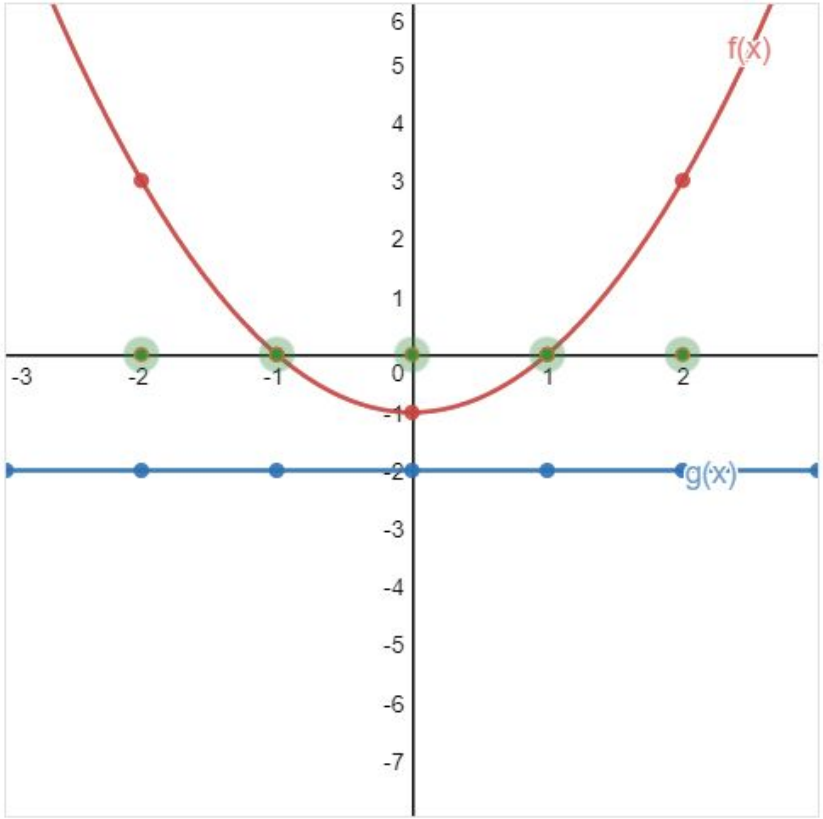
4. Bite Sized Tasks

5.

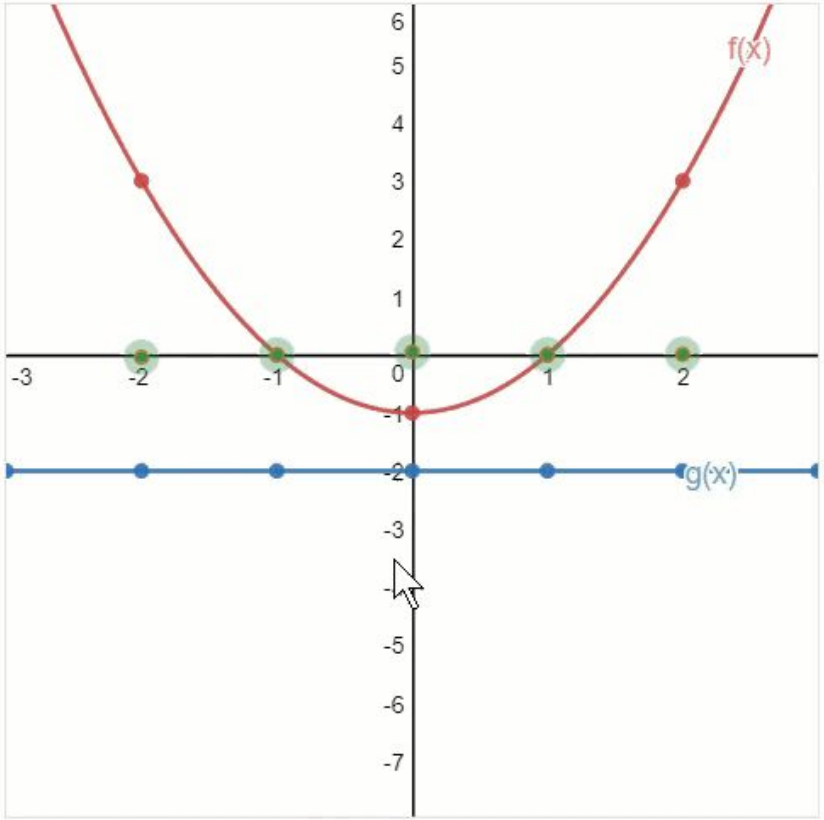
4. Bite-Sized Tasks

- Graphing Rational Functions - Activity 1



Drag the green dots to represent the product of $[f(x)][g(x)]$.

Source: Sam Shah - Continuous Everywhere But Differentiable Nowhere



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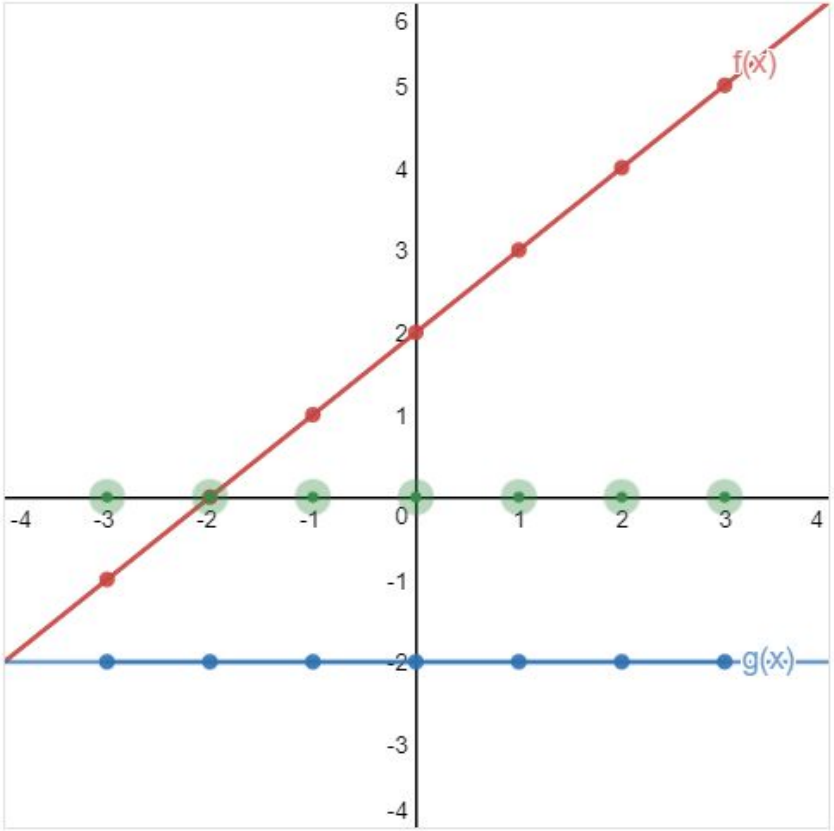
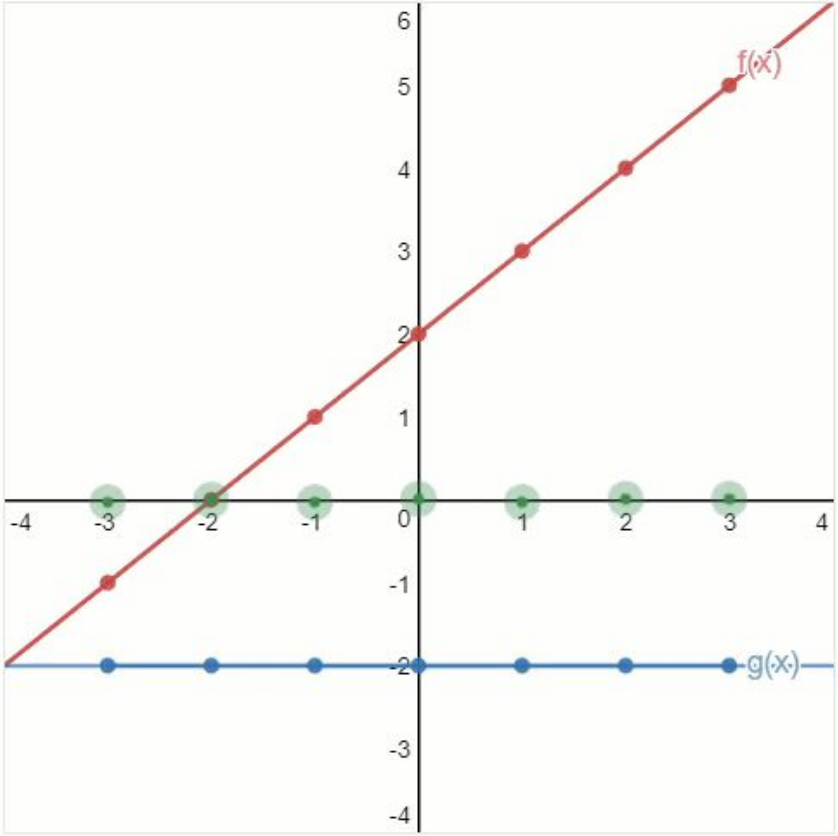


Drag the green dots to represent the quotient $\frac{f(x)}{g(x)}$.

Source: Sam Shah - Continuous Everywhere But Differentiable Nowhere



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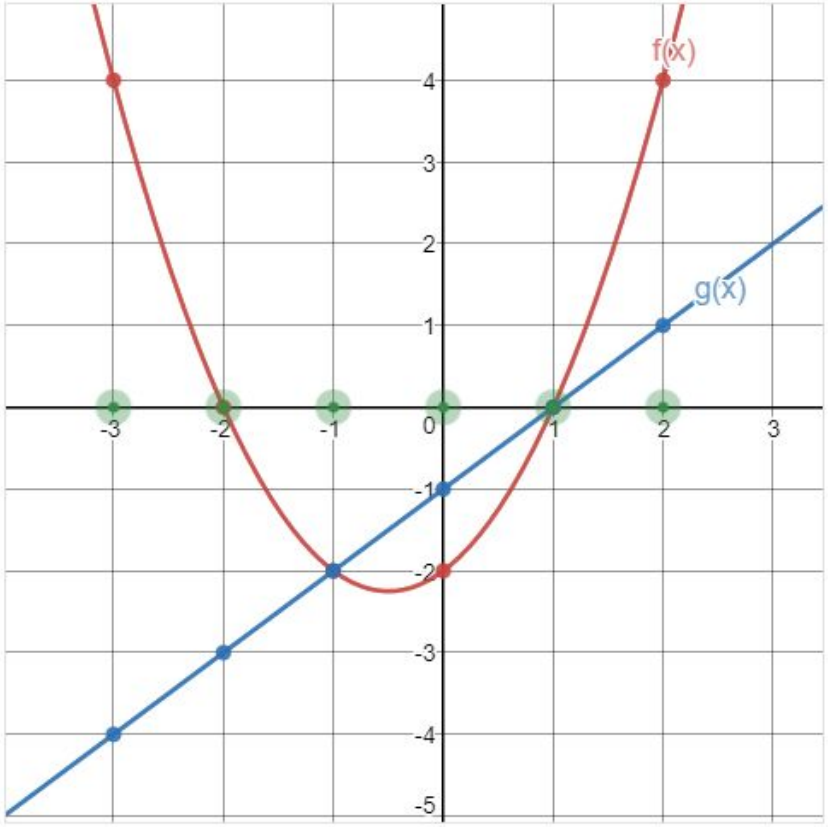

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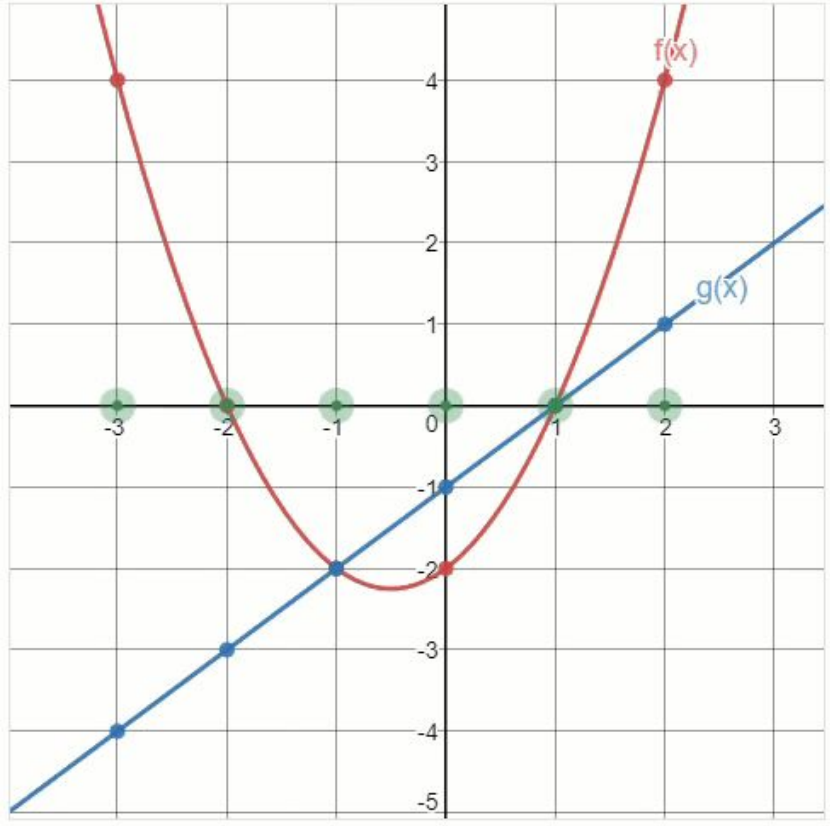

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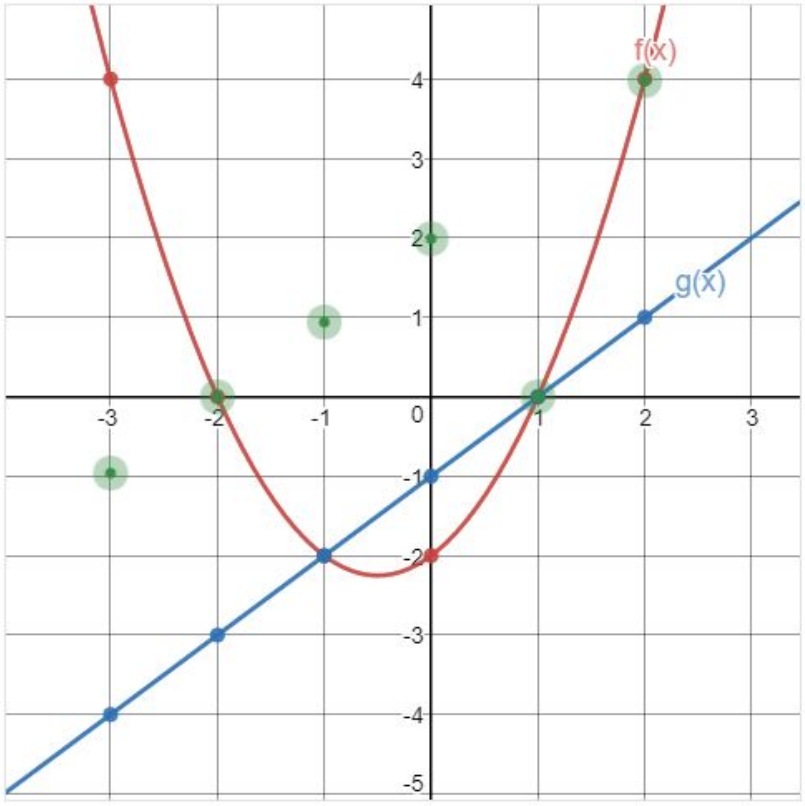
Source: Sam Shah - Continuous Everywhere But Differentiable Nowhere

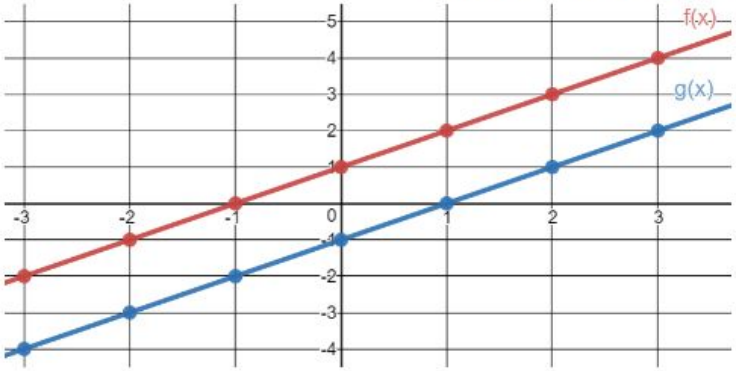


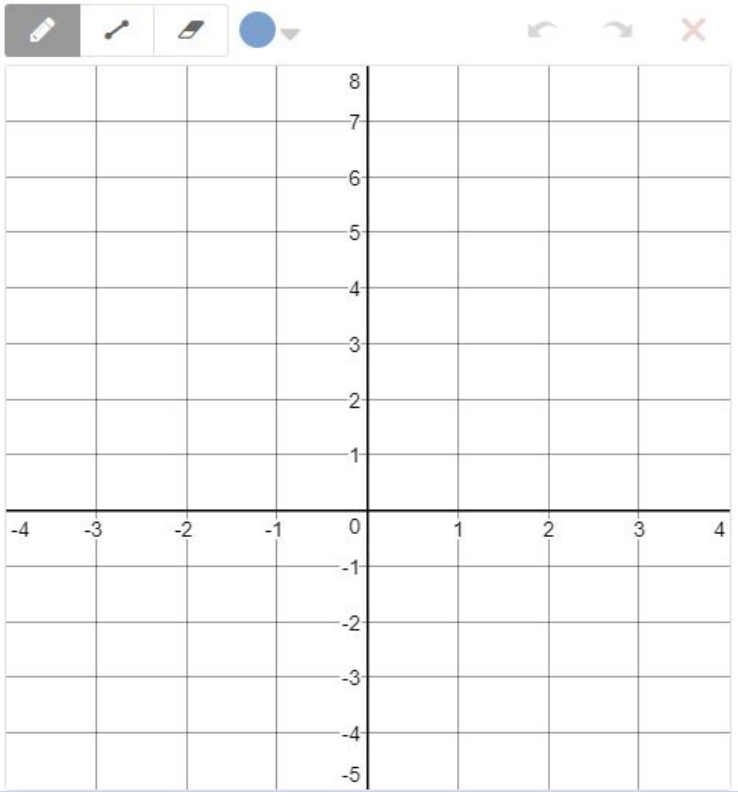
When considering the quotient $\frac{f(x)}{g(x)}$, one of those points may have presented a problem. What was the issue? What strategy did you use to overcome the problem?

Submit to Class

Source: Sam Shah - Continuous Everywhere But Differentiable Nowhere

Sketch a graph of the quotient of f(x)/g(x)





Source: Sam Shah - [Continuous Everywhere But Differentiable Nowhere]

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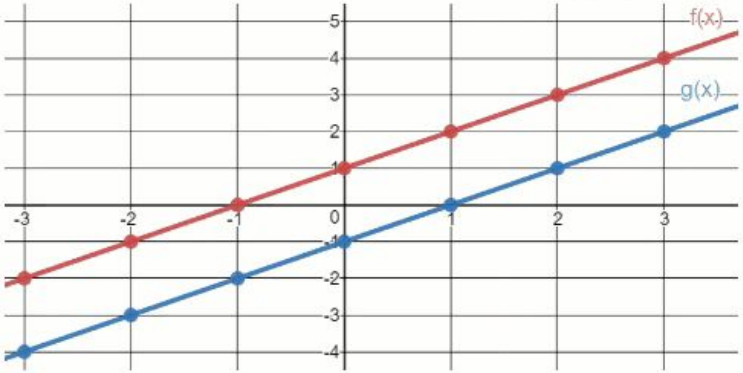
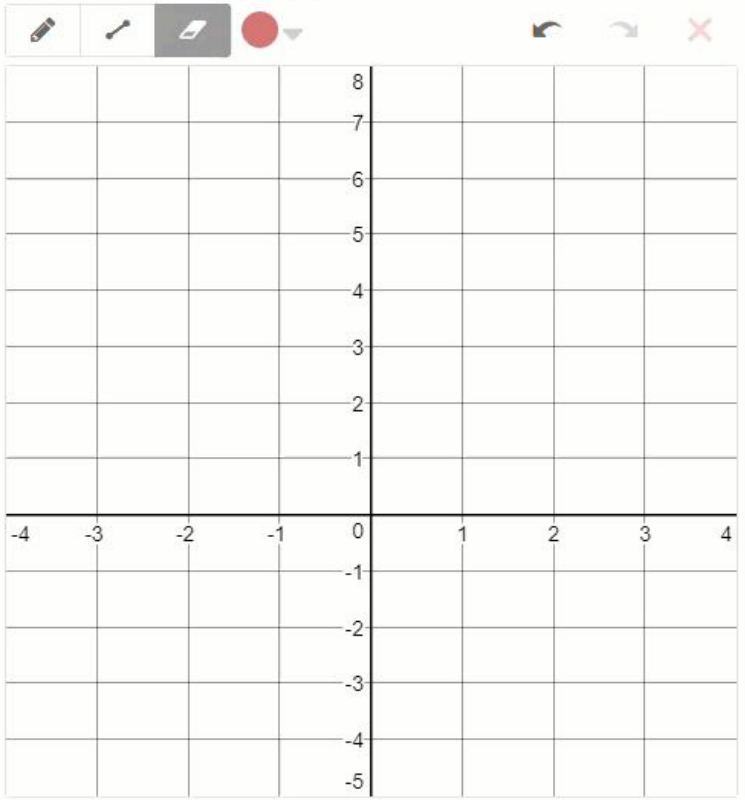
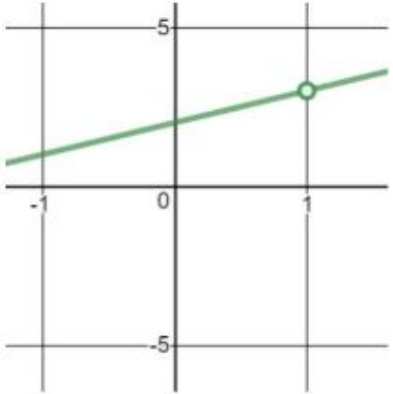
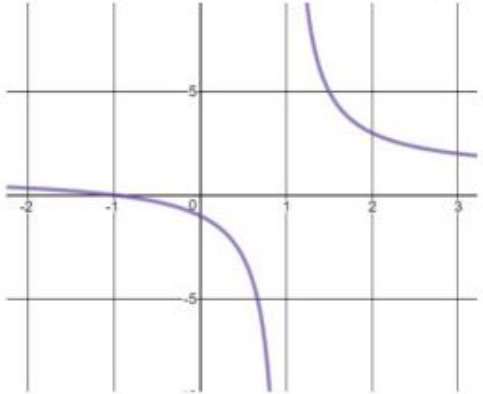




Source: Sam Shah - [Continuous Everywhere But Differentiable Nowhere]

Take Note...

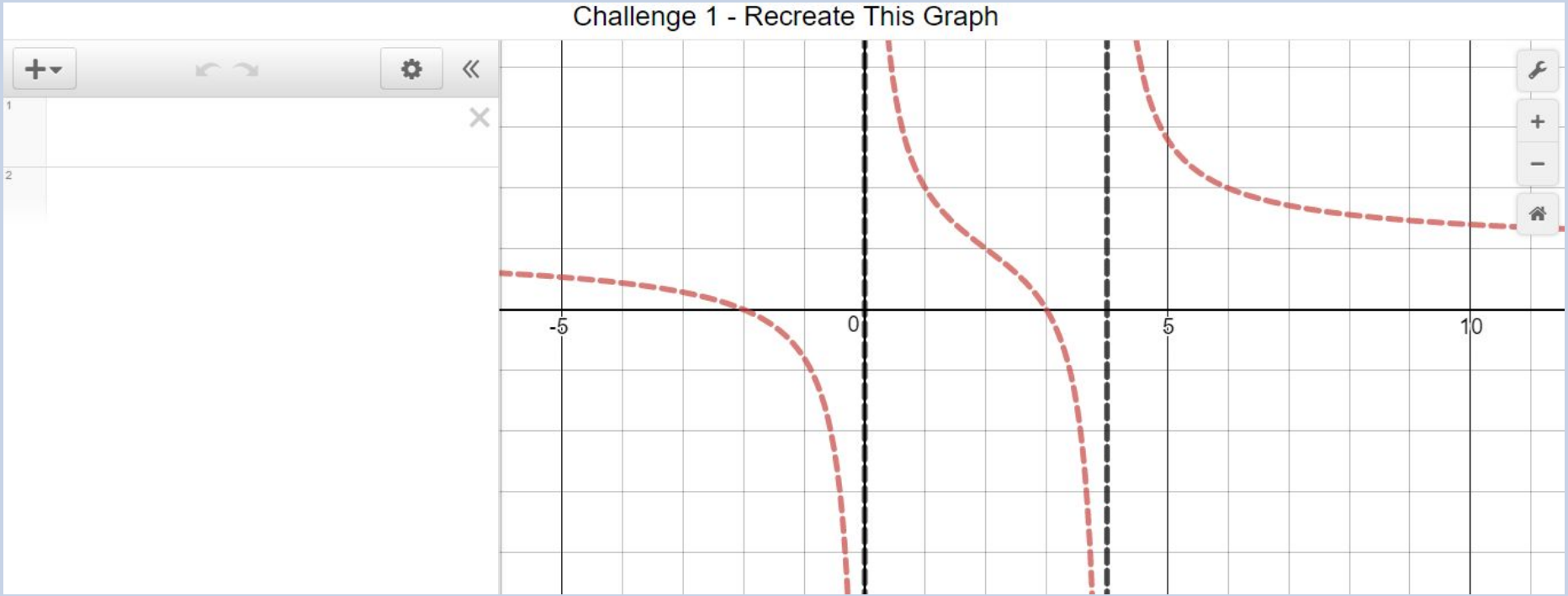




When dividing functions $\frac{f(x)}{g(x)}$, the graph is "undefined" when the denominator has an output of zero. When g(x) = 0, the result is either a hole in the graph (green graph) or a vertical asymptote (purple graph).

To revisit this concept, go back and explore slide 5, slide 7, or slide 8.

Source: Sam Shah - Continuous Everywhere But Differentiable Nowhere



Source: Sam Shah - [Continuous Everywhere But Differentiable Nowhere]

4. Bite-Sized Tasks

- Graphing Rational Functions - Activity 1
- T makes connections & sets up next activity
- Graphing Rational Functions - Activity 2

Learning Target 39: Analyzing Rational Functions

Activity 39.2

Analyze the end behavior of the rational functions by exploring the limit as x approaches extremely large values and extremely small values. Answer each limit with a specific number, positive infinity $(+\infty)$, or negative infinity $(-\infty)$

(a) $p(x)=\dfrac{x^6-2}{x^6}$

(b) $a(x)=\dfrac{5x^6-2}{x^6+1}$

(c) $c(x)=\dfrac{5x^6-2}{x^8+1}$

Fostering Inquiry - 5 Things To Know

1. Group Norms

2. Goals

3. Prior Knowledge

4. Bite Sized Tasks

5.

Fostering Inquiry - 5 Things To Know

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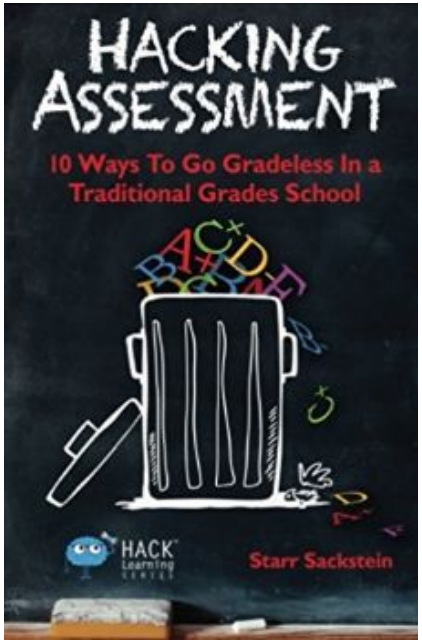
5. Student Reflection

5. Classroom Discussions & Reflections

- What was your understanding of the activity/task?
- What did you do to achieve success?
- What challenges did you face? How did you respond?
- Provide a convincing description of your solution.
- If you could do it again, what would you do differently?

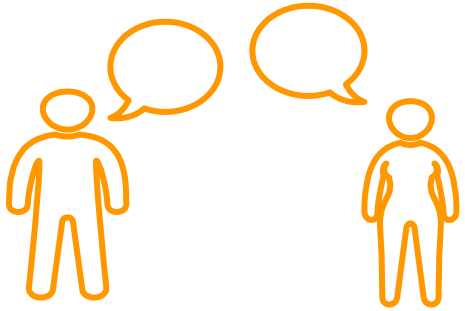


Source: Hacking Assessment - Starr Sackstein

Preview Activity

- Taps into the prior knowledge of the student
- Immediate engagement for the student
- Foreshadows upcoming concepts
- Completed by the student BEFORE the lesson is taught

The Activities



- Breaks the concept down into bite-sized chunks
- Usually 2 - 4 activities per concept
- Inquiry based group work
- Teacher backfills information, debriefs, and makes connections
- Teacher provides examples only when necessary

The Exercises

- 3 - 4 challenging problems with multiple parts
- Connects key ideas
- Dives deeper into the concept
- Worked individually by the student
- Supplement with drill work (if needed)

Call To Action

- Establish (and revisit) Classroom Norms
- One inquiry based lesson for an abstract topic
- Be less helpful

Resources

Preview Activities

- Desmos Activity Builder
- WODB
- Active Calculus
- Illustrative Mathematics

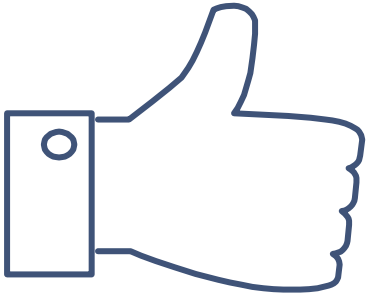
Activities, Tasks, Exercises & Extensions

- Phillips Exeter Academy (problem based curriculum)
- Brilliant.org (source of rich problems)
- Active Calculus (inquiry based Calculus book)
- Illustrative Mathematics (problem based curriculum)
- Underground Mathematics (source of rich problems)
- Calendar Problems (MT Magazine)
- NRICH Mathematics (source of rich problems)
- Mathematics Vision Project (MVP)
- MARS (problem based curriculum)
- Open Middle (source of rich problems)

Resources

Books, Articles & Blogs

- Pathways To Proficiency (Book)
- Classroom Norms (resource website)
- Mathematical Mindsets (Book)
- 100 Numbers Task (Sara VanDerWerf)
- Why Inquiry Fails (David Wees)
- Engagement In Mathematics (Dan Meyer)
- Hacking Assessment (Starr Sackstein)
- Continuous Everywhere But Differentiable Nowhere (Sam Shah)



THANKS!

Any questions?

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