

Debbie Gochenaur, Shippensburg University
MAA Joint Meetings, Atlanta GA
Saturday, January 7, 9:00 – 10:20 a.m.
Marriott Hotel, International 5

ROADBLOCKS FOR IMPLEMENTING ACTIVE LEARNING STRATEGIES IN CALCULUS COURSES

Darryl Yong, Harvey Mudd College

Kim Presser, Shippensburg University

Larissa Schroeder, University of Hartford

<http://bit.ly/2ivHjVR>

What is active learning?

- Teaching methods to get students more involved in the learning process
- i.e. Techniques for engaging students
 - with each other AND with the content
- Remember, IBL is *active learning* but *active learning* is not necessarily IBL.

Why active learning?

- President's Council of Advisors on Science and Technology:
 - *increase the number of STEM bachelor's degrees completed per year by 33%*
 - *recommends adoption of empirically validated teaching practices as critical to achieving that goal.*
- Freeman et. al. (2014)
 - Compelling analysis of active learning strategies
 - *Active learning leads to increases in examination performance that would raise average grades by a half a letter*
 - *Failure rates under traditional lecturing increases by 55% over the rates observed under active learning.*
- For info on IBL see the latest Primus, vol. 27, issues 1&2

Darryl Yong

Harvey Mudd College

- **Personal and Institutional Roadblocks**
 - Department & Institutional culture
 - Training & Support
 - Student Expectations
 - Personal Expectations & Worries
 - Be yourself!

Kim Presser

Shippensburg University

- Establishing community
- Ask yourself, Why?
- Managing groups

Establishing Community

- Create a friendly atmosphere.
 - *Get to class early, ask questions, get to know the students.*
 - *Refer to students by name, especially when giving credit for ideas.*
- Help students to feel comfortable answering questions and sharing their work in informal ways.
 - *Invite pairs of students to discuss their answers then come to the board or share their answers with the class.*
 - *Request contributions by row, column, pods of 4, etc.*

Establishing Community

- Help students to get to know others in the classroom.
 - *Introductions*
 - *Ice-Breakers*
 - *Variety*
- Encourage communication outside of the classroom.
 - *Advertise related events in department or across campus*
 - *Meet students in lounge or tutoring area*
 - *Discuss advisement issues as a class*

Ask Yourself Why?

Why am I choosing to do group work?

- Concept exploration
 - *Provide detailed instructions*
 - *For frequent use rotate groups often*
 - *For long-term projects encourage self-selected groups*
- Concept check
 - *Informally gather students to answer questions*
 - *Alternate the output: discussion, shared on board with class, turn-in worksheet*

Ask Yourself Why?

- Concept review
 - *Heterogeneous groups*
 - *Graded or ungraded assignment*
 - *Prepared materials of suitable length (more is better than less)*
- Concept mastery
 - *Homogeneous groups*
- Other

Ask Yourself How?

How much class time is available?

- 5 minutes
- 15 minutes
- Entire period

How will I assess their work?

- One sheet for the group or individual sheets
- Correctness vs. Effort
- Wait to reveal output until later in the period
- Be adaptable

How much of the semester will they be working on this project?

Managing Groups

- Provide formal instruction for how “groups” work. Nothing is too obvious.
 - *Introductions and contact information*
 - *Arrangement*
 - *Establishing member roles.*
 - Example: Choose a facilitator who helps guide you through the questions, a recorder to take notes for your group, and a speaker (or 2) to present your summary to the class. It is okay if you don’t get to every question, but keep the discussion flowing.
- Get student feedback
 - *Publicly and privately accept student feedback*
 - *Formal feedback for long-term projects*
 - *Move to self-selected groups later in the semester*

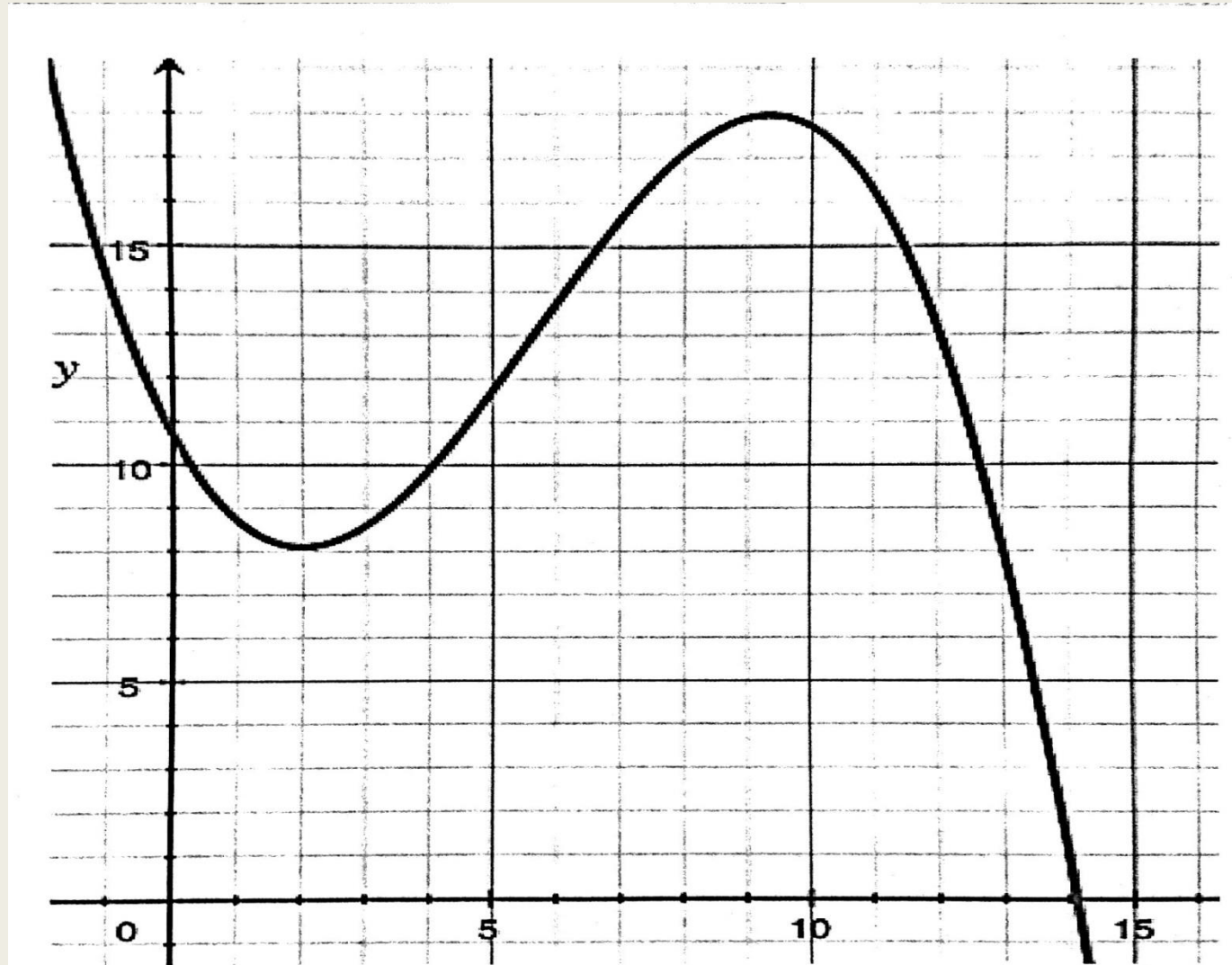
Larissa Schroeder

University of Hartford

Getting Started: Choosing or Modifying Tasks

Choose tasks with multiple entry points and the potential for discussion.

Estimate the area of the region trapped between the function and the x - and y -axes using a minimum of 7 subdivisions.



Find tasks from other sources

Given the graph of $f(x)$, which value is the best

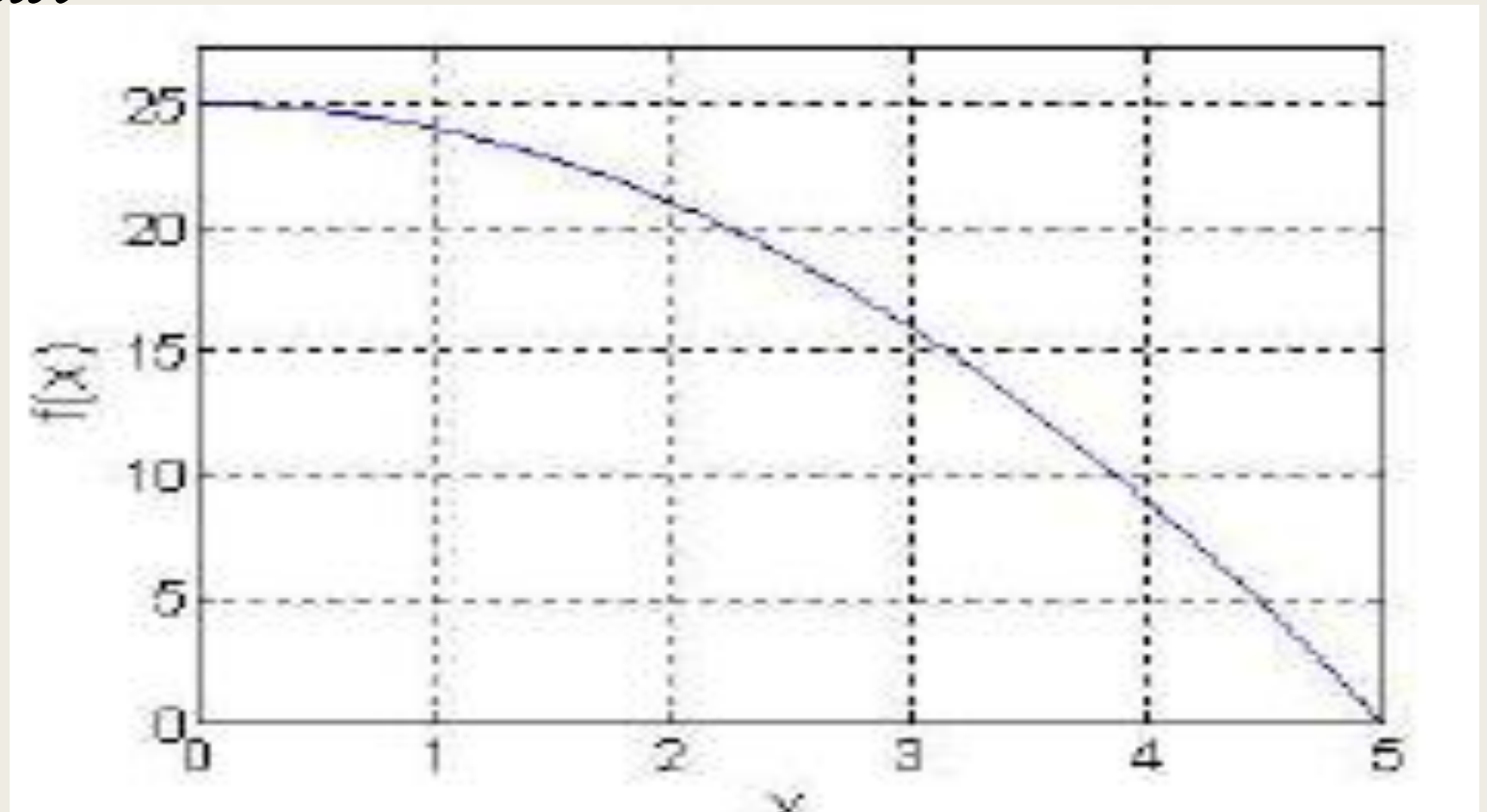
estimate of $\int_0^3 f(x) dx$

A. 13

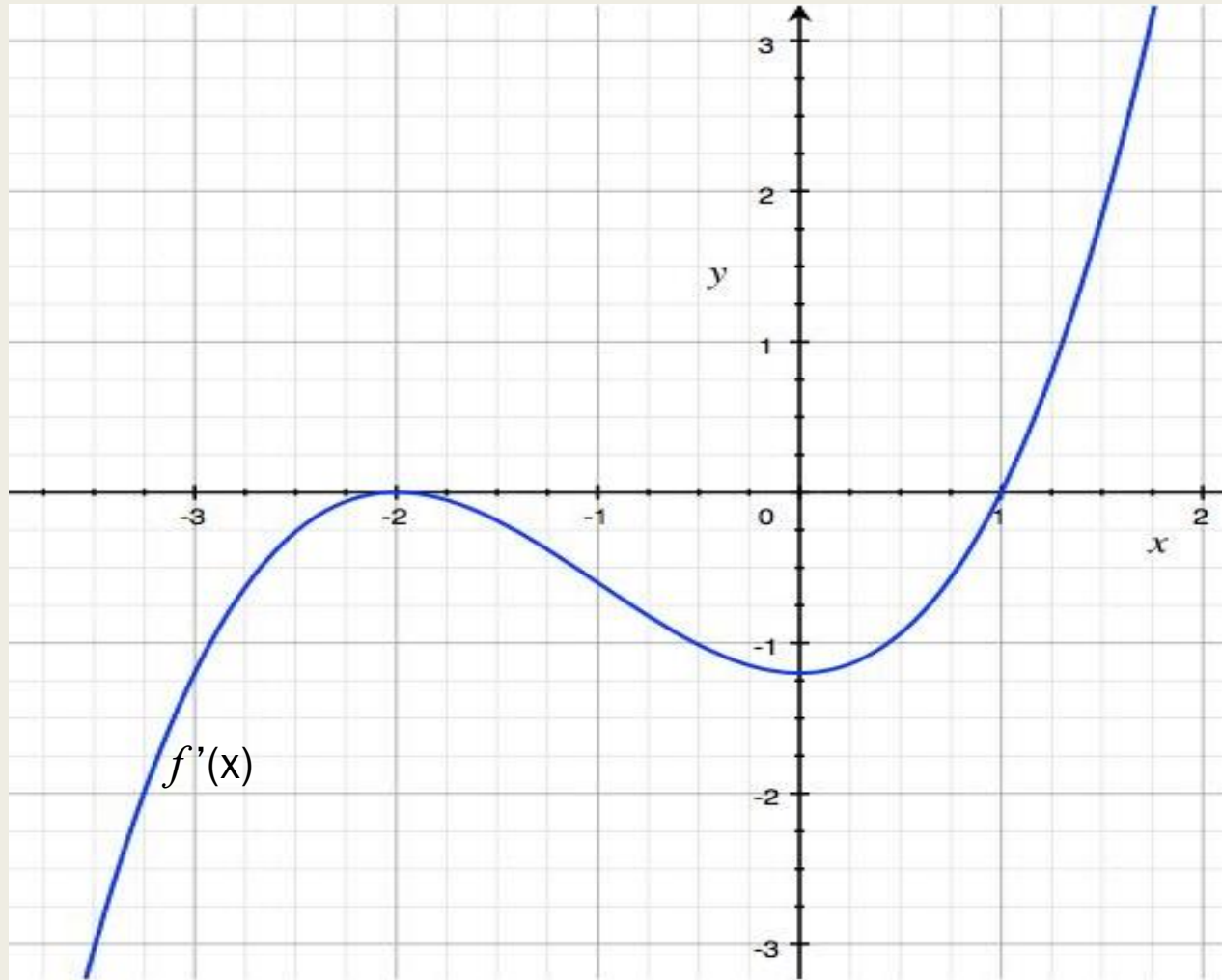
B. 17

C. 65

D. 85



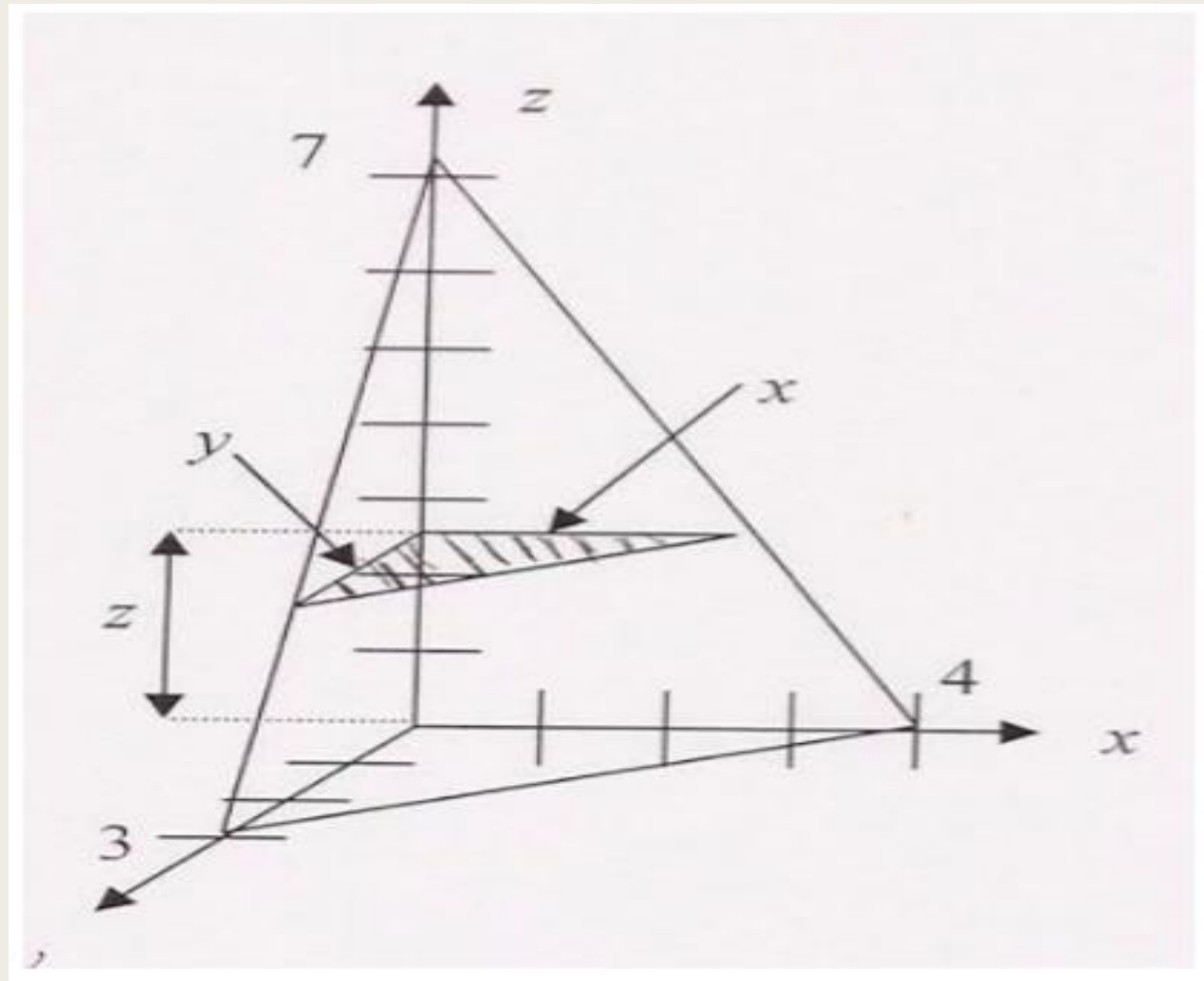
Modify a task to promote discussion



What is wrong with this statement?

“It is decreasing, so it is concave down”

Allow students to struggle with traditional problems



But have a plan about where to go

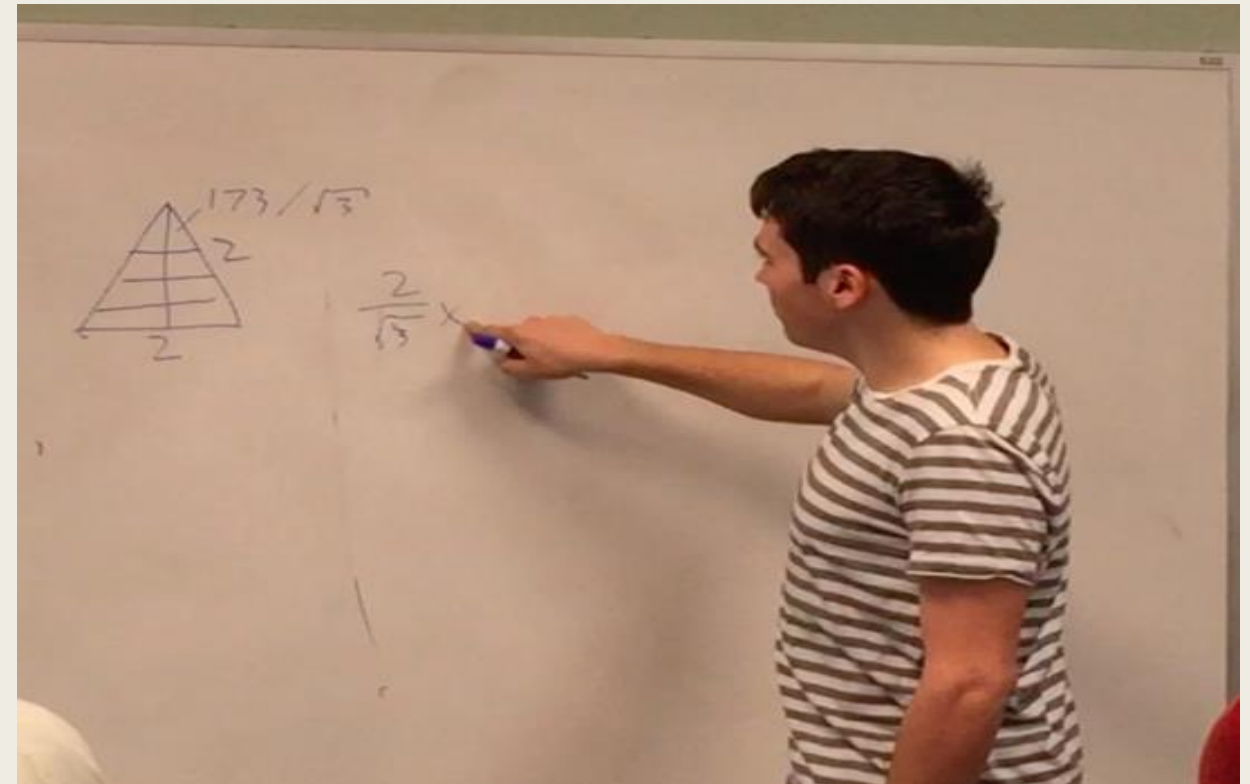
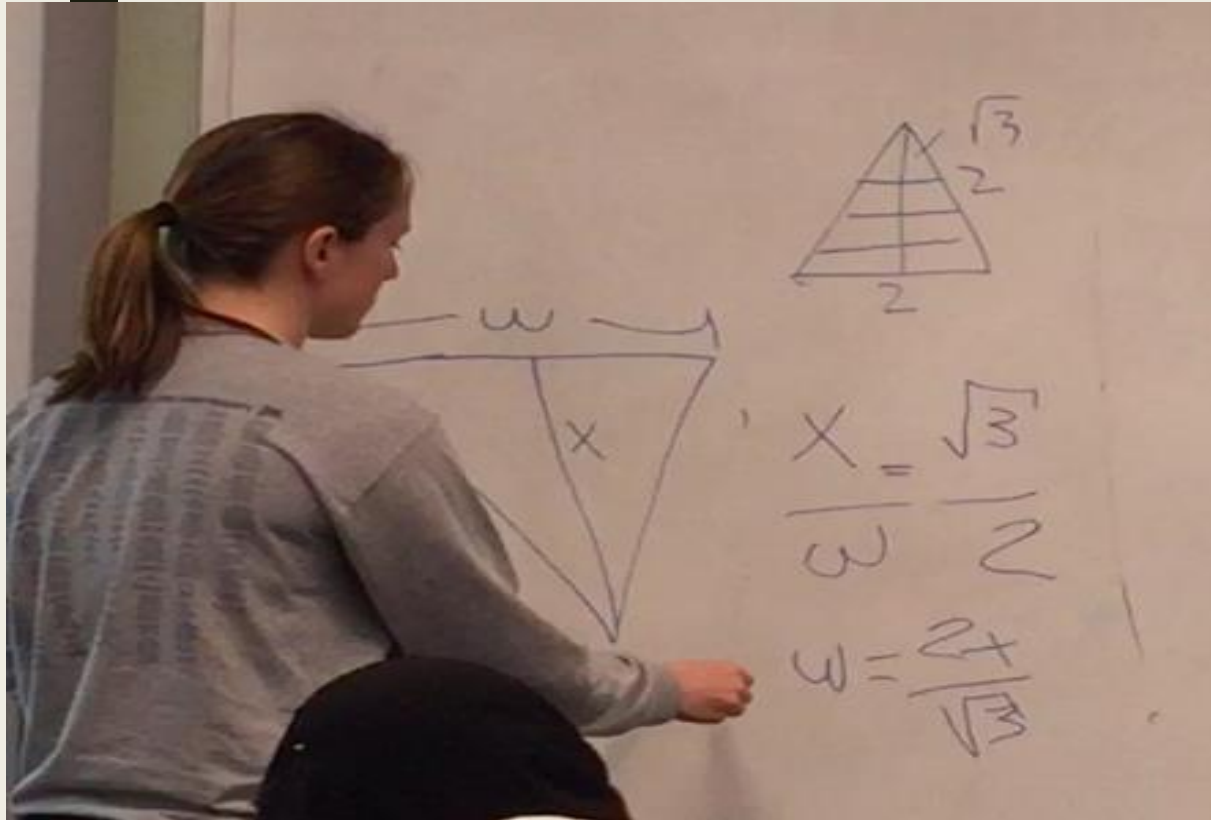
Use Inquiry-Oriented Tasks

$$\sum_{k=1}^{\infty} \frac{x^k}{2^k}$$

$$\sum_{k=1}^{\infty} \frac{x^k}{3^k}$$

- Find values of x which make the series converge.
- Find values of x that make the series diverge.

When students explain their thinking it takes time



Instructors need strategies to foster Classroom Discussion

Revoicing

“So, you are saying...”

Ask students to **restate** someone’s reasoning

“Can you repeat what Ana just said?”

Ask students provide a **critique**

“Do you agree or disagree? Why?”

Prompt students to add on

“Sam would you like to add to that explanation?”

Wait...wait....wait!

Resources

- Active Calculus (Boelkins, Austin, & Schlicker)

<http://scholarworks.gvsu.edu/books/10/>

- MathQUEST/MathVote

<http://mathquest.carroll.edu/>

Audience Questions

<http://bit.ly/2ivHjVR>

