

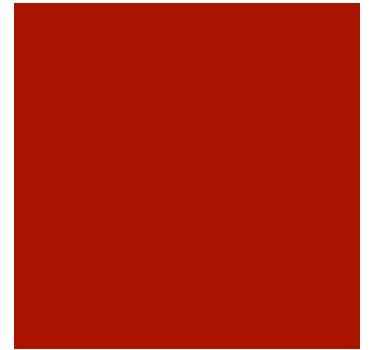


Socratic Seminar in Math: Development of Math Reasoning Collaboratively

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NCTM 2013

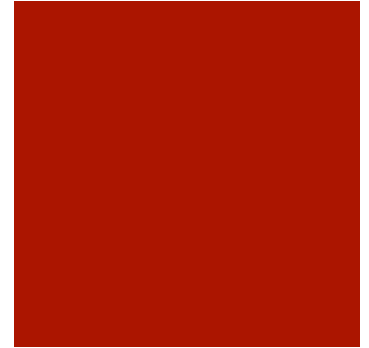
What is Socratic Seminar?

- In-depth mathematical conversation
- Collaboration
- Sharing and Questioning of work



Benefits

- The natural social side of the adolescent
 - 80% of reflective exit slips mention enjoyment of conversational style of seminar
- Questioning/Reasoning skills developed
 - More specific ID of student questions in understanding
- Understanding of one's own skills
- Students make mathematical arguments
- Mathematical connections made through dialogue
- All CCSS Mathematical Practices
- Genuine mathematical situations
- Authentic assessment



Expectations

Student led - with a little teacher guidance

- Respect & Consideration for each other
- Agree/Disagree with statement, not people
- Right & Wrong answers are all important
- EVERYONE contributes (we aren't finished until everyone talks)
- Speaking limits – 2X until everyone talks

- 1.) Consideration of others
- 2.) Disagreements of statements
- 3.) Everyone speaks ATLEAST once
• 3) Everyone makes an effort
- 5.) Everyone gets attention
- 6.) Share two times until everyone has shared once
- 7.) Respect for each others statements
- 8.) Everyone ends their statement with a question
ENDS

Seating Options

- Seating Arrangements
 - Circle, Fishbowl, Horseshoe

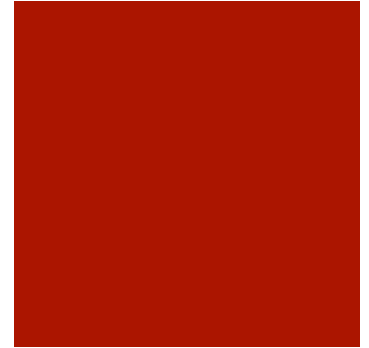
Notice, NO teacher seat

- Uses of seating chart
 - Conversation following (volunteer)
 - Speaking count (volunteer)



Statement – Question

- Ending with a question
 - Why?
- Student Dialogue Examples
 - I agree that the formula for area of a rectangle is... but what if I divide the shape into triangles? Does anyone know the formula for area of a triangle?
 - I can't remember what a function is, can anyone tell me?
 - I think a function can also be...but does anyone know how to use the data from the chart to find the function formula?
 - I don't think the formula for area of a square and area of a rectangle are the same because...can anyone help me figure out if that is true?

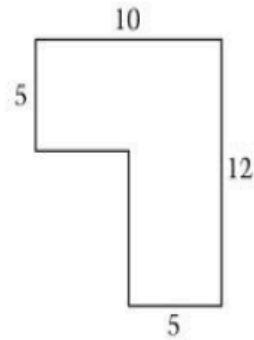


Creating the Tasks...

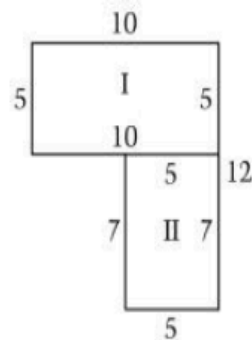
- NAEP released items
- UT Dana Center
- PARCC website
- CCSSM toolbox
- NCTM daily questions
- NCTM Illuminations



Task Example – Discussion Starter (What did Ted do and why?)



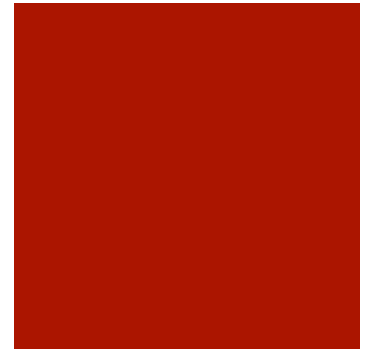
29. Ted wants to purchase floor covering for the hallway shown above. He knows there are many ways to find the area of the hallway. One way is to divide the hallway into the sections shown below and then add together the area of each section.



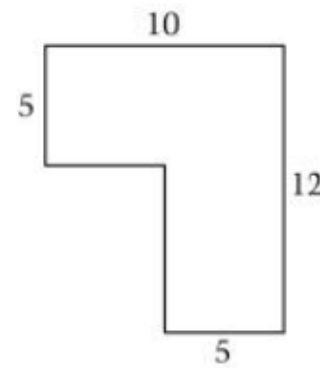
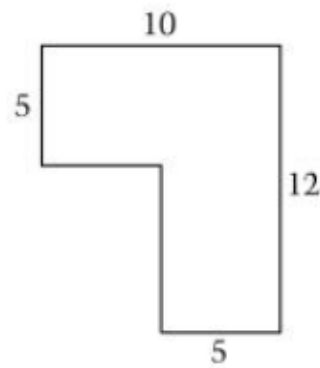
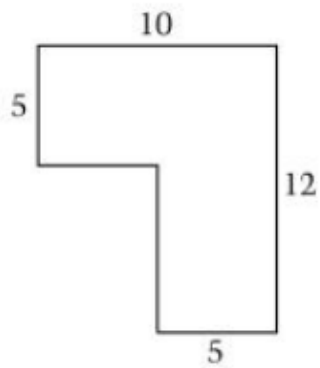
$$\begin{aligned} \text{Area of Hallway} &= \text{Area of Region I} + \text{Area of Region II} \\ \text{Area} &= (5 \times 10) + (7 \times 5) \end{aligned}$$

NCES. (2013). *NAEP Questions Tool*. Retrieved from <http://nces.ed.gov/nationsreportcard/itmrlsx/detail.aspx?subject=mathematics>

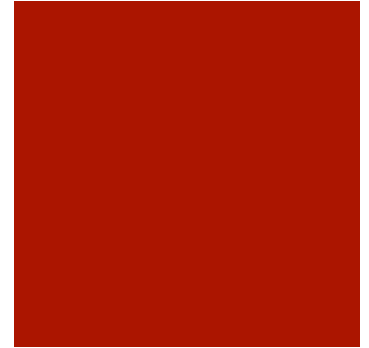
Follow Up Task



Use the figures below to show 3 other ways that Ted can divide the hallway to find its area. Below each figure explain what numbers and operations Ted could use to calculate the area.

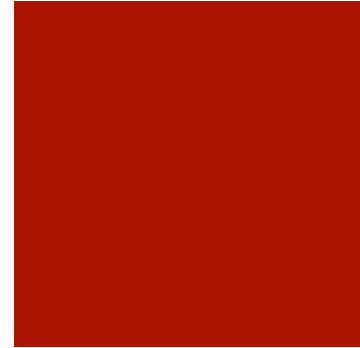


Probing Questions



- Prepare Probing Questions Ahead of Time
 - What if they get stuck?
 - How do they get started?
 - Write the questions! Don't ask low level questions.
- Question Development
 - Dana Center tasks – the work is done for you
 - PBS questioning card
 - http://www.pbs.org/teachers/_files/pdf/TL_MathCard.pdf

Authentic Assessment

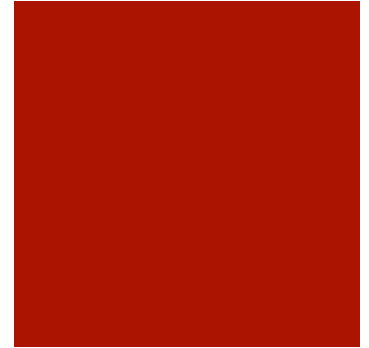


- Consider the standards
- Questions to ask yourself
 - What do you need to assess?
 - How do they show you?
 - How do they obtain points? Is anything worth more?
 - I.E. Are procedural skills worth more points than multiple representations?
 - Show the students the rubric
 - What about students that don't speak as much?
 - Should they do the problem independently prior to the S.S.?

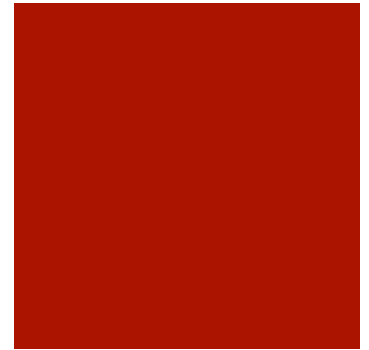
Student Name	Understands function dependence and independence	Represents Relationships in Multiple Formats	Explains Reasoning	Critiques Reasoning of Others	Looks for patterns	Uses Symbols to Represent Unknowns	Uses Procedural Skills to Check Work

Be Successful...

- Consider your students
 - “Easy” tasks first
- Engage
 - Pictures/Recent Experiences/News Stories
- Prepare your own probing questions
 - Keep up the momentum
- Record
 - For assessment purposes
- DON'T ANSWER THE QUESTION!!!
- Don't give up!
 - 2 - 4 “training” sessions



Example – The Starter



Fischer, C. (2009). *Pavement Fractals*. Retrieved from the Big Bang Mosaics website at <http://www.bigbangmosaics.com/gallery.htm>

The Question and Student Work



Chapter 1: Function Fundamentals

Mosaic 1 Mosaic 2 Mosaic 3

$f(x) = 3x + 2$
 $f(x) = (x-1) + 5$
 $f(1) = 5$
 $f(x) = (x-1) + 5$
 $f(2) = (2-1) + 5$
 $1 + 5 = 6$

5 8 11

Reuben learned in art class that a mosaic is made by arranging small pieces of colored material (such as glass or tile) to create a design. Reuben created a mosaic using tiles, then decided on a growing pattern and created a second and third mosaic. Reuben continued his pattern by building additional mosaics. He counted the number of tiles in each mosaic and then represented the data in multiple ways. He thinks he sees a relationship between the mosaic number and the total number of tiles in the mosaic.

1. Represent Reuben's data from the mosaics problem in at least three ways, including a general function rule, to determine the number of tiles in any mosaic.

$f(x) = 2x + 3$
 $f(x) = 3x + 2$
 $f(1) = 3(1) + 2$

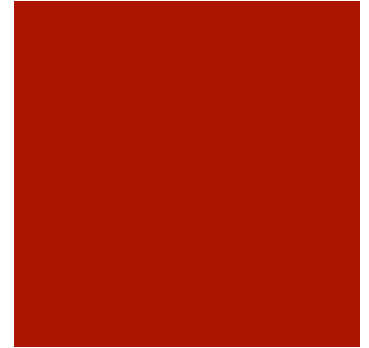
"chart"
 "table"
 "graph"

UTA Dana Center. (2013). *Chapter 1: Function fundamentals*. Retrieved from http://www.utdanacenter.org/mathtoolkit/downloads/alg1assess/alg1_mosaics.pdf

Outcomes

(data, anecdotal observations, and student reports)

- Higher scores on constructed/extended response items (standardized assessments & classroom)
- Higher student mathematical self-efficacy
- Less assessment anxiety
- Higher scores on follow-up assessments
- Higher teacher understanding of diagnostic info



Thank you!

I value your feedback! Don't forget to use the NCTM app.

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