



## Argument-Based Math Talks

### Overview

Math Talks have become a go-to routine for many math teachers in their response to the new wave of math standards that call for a much greater emphasis on requiring students to justify their solutions, to communicate their mathematical reasoning, to make arguments with math, and to think critically about the mathematical reasoning and arguments of others.

Math Talks as a routine activity are designed to open the class period with a single problem drawing on math content directly relevant to the day's lesson. The problem should be sufficiently complex to allow for multiple strategies to solve it. Students should solve the problem individually, thinking meta-cognitively about the strategy they use to solve the problem. Students should then be called on to explain their solution to the problem and the strategy they used. Math Talks close with a teacher-led discussion of the various strategies, comparing their strengths and weaknesses.

What makes our version of the Math Talks routine argument-based is that students are asked to make arguments about which strategy is most effective in solving the problem, and (if they were called on to present a solution) to respond to the arguments that oppose their own solution strategy.

Math Talks ask for some additional upfront time investment from teachers in learning their effective design and implementation, and they consume classroom opening time (a segment of the period that otherwise is often used for Bell Ringers). But these investments can pay off several-fold in student understanding of math concepts and deeper thinking about math strategies and processes. As Ben Austin of the Erikson Math Collaborative has written (April 9, 2014)

Selecting problems that will make specific concepts evident to students is the first step. The teacher must also anticipate possible student responses and practice the mathematical model that best represents each student's thinking. Inevitably, students solve the problem using a method the teacher had not imagined, in which case some level of improvisation is required. In the end, both teacher and student may be challenged, but those challenges can result in increased understanding for everyone involved.

## Method and Procedure

- (1) Choose a problem that is directly relevant to the day's lesson. Be sure that it is complex enough to allow for multiple strategies to solve it. Write out the problem on the board or put it on the projector.
- (2) Give students up to five minutes (the first five minutes – start right when the bell rings) of class to solve the problem. They should be told to be meta-cognitive about the strategy they use to solve the problem – what it is, how it works, why it works. Also, students should be told that they can, if they have time, use more than one strategy to solve the problem. After the second or third time using this routine they won't need to be reminded to be meta-cognitive in these ways: they will be part of the routine.
- (3) After they've been given up to five minutes to solve the problem (less time if the problem shouldn't take up the full five minutes to solve), ask students to show by putting up fingers the number of strategies they used to solve the problem.
- (4) Then call on a student who had multiple fingers up (assuming there are some) to stand and (a) give their solution, and (b) describe each step of the strategy they think works best. You should be writing out on the board (or on a portion of the projected page) the solution strategy. Then give the solution strategy a name – something that describes it, e.g., the Cross-Multiply Strategy – and write that name over the written strategy.
- (5) Ask the class who used a strategy to solve the problem other than the first one. Cold call one of these students – or ask for a volunteer from one of these students – and have them (a) give their solution, and (b) describe each step of their strategy. Write the strategy out on another portion of the board, or on another sheet that you can project, and then name it –

all as you did with the first strategy. Cycle through this process one more time, so that you have three strategies now on the board or projector.

- (6) Turning to the remainder of the class – those students who have not offered up a solution and described a strategy – and ask them if anyone has an argument either for or against any of the three strategies to solve the problem that are on the board. An argument should have a claim and support for the claim. That support should contain evidence and reasoning, or reasoning alone.

Evidence in this context would be a reference to the computation in the solution. Evidence should always be factual and objective, so evidence here should refer to the work done on the board. Reasoning should be logical and analytical. It should make sense of the computation, the steps taken in the strategy, and the warrants (or the lack of warrants) for steps or moves in the strategy.

Claims take the form of this template:

**“The \_\_\_\_\_ Strategy is the best/not the best strategy for solving this problem because it is/is not \_\_\_\_\_.”**

The first blank should of course be filled in by the name of the strategy that is the subject of the claim. The second blank should be filled in by a criterion for effective strategies for solving math problems. Here is a partial list of criteria for effective solution strategies (formulated in adjectival, descriptive form).

**Accurate**  
**Applicable to the widest range of similar problems**  
**Best reasoned**  
**Creative**  
**Efficient**  
**Elegant**  
**Grounded in the math principles or rules we are currently studying**

Track these arguments by writing out the claim next to the relevant solution strategy.

- (7) After 3 – 5 cogent arguments have been made either for or against the strategies presented, give an opportunity to the students who presented the strategies to respond or refute the



arguments that are either against their own strategy or in favor of another student’s strategy. Responses in this context should begin by referencing the argument:

**“Someone [or the student’s name] argued that \_\_\_\_\_ [fill in the claim here], but I disagree [or, I don’t fully agree].”**

The disagreement – the response or refutation – should focus on the support for the claim, its evidence or its reasoning. The response should find something flawed or vulnerable to disagreement in this support.

- (8) The activity should conclude with a teacher-led discussion of the comparative solution strategies, and what the class has learned from the argumentation about them.