Making Mistakes in Math Class

Creating A Culture of Learning

Challenges I face as a teacher...

1. How to ask better questions.
2. What happens when you ask questions and they don’t answer correctly?

There are usually a few students who always know the right answer.

But what happens when you, the teacher, know that there are more incorrect answers floating around?

close! um, no..
not quite... almost
try again

Too often, when the question is correctly answered, we think we are finished.

But maybe this should only be part of the answer we are seeking.

Teaching students to examine their wrong answers helps to build confidence, reflection, and critical thinking skills.

How can we use wrong answers to help learning?

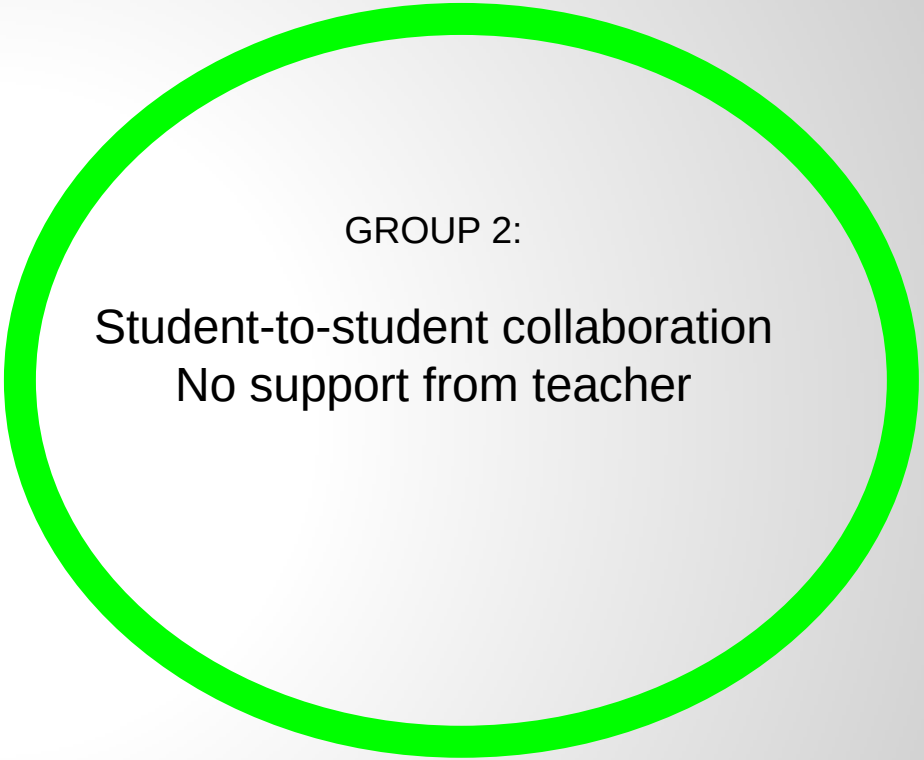
In a study published in the Journal of the Learning Sciences in 2012, Dr. Manu Kapur and Katerine Bielaczyc tested the concept of “applied failure” in three schools in Singapore. With one group of students, the teacher provided intensive “scaffolding”—instructional support—and feedback. With the teacher’s help, these pupils were able to find the answers to their set of problems. Meanwhile, a second group was directed to solve the same problems by collaborating with one another, absent any prompts from their instructor. These students weren’t able to complete the problems correctly. But in the course of trying to do so, they generated a lot of ideas about the nature of the problems and about what potential solutions would look like. And when the two groups were tested on what they’d learned, the second group “significantly outperformed” the first.

GROUP 1:

Teacher provided support
Strong feedback from teacher

GROUP 2:

Student-to-student collaboration
No support from teacher



How Could I Bring this Culture to My Classroom?

What changes did I, as the teacher, need to make, in order to facilitate these cultural changes?

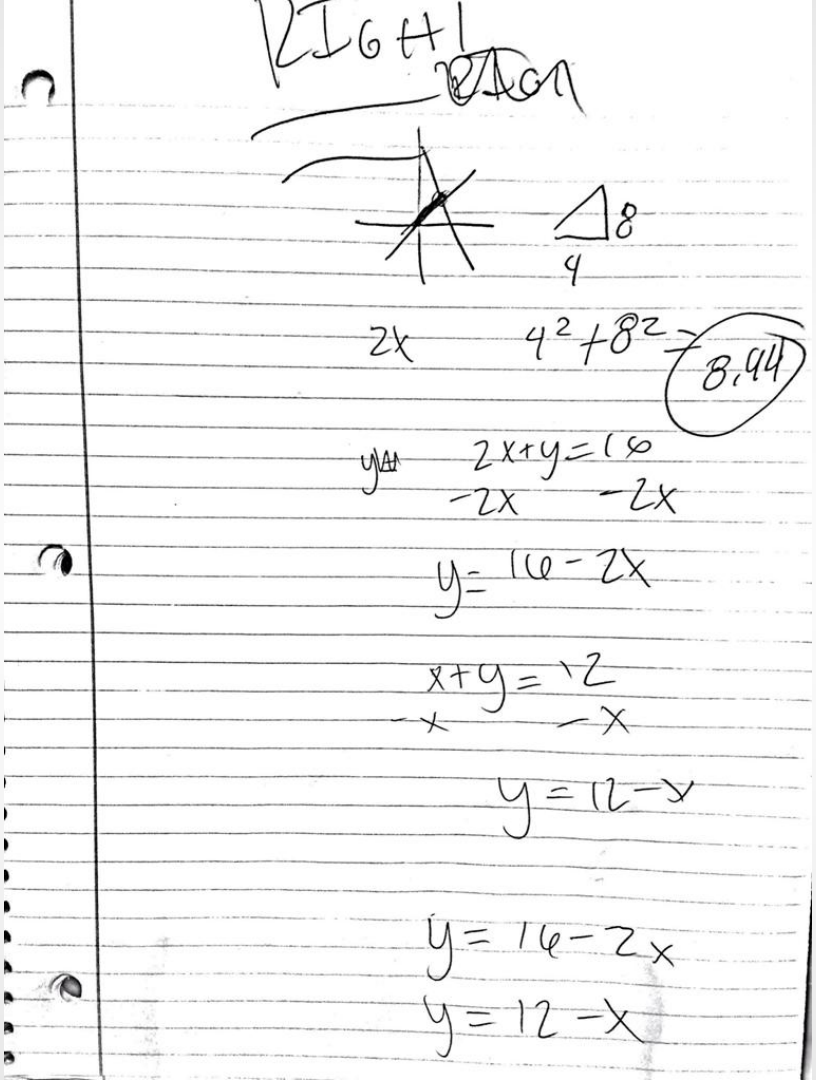
TAKING THE FIRST STEP:

Read the question below. Then, find the correct answer as well as 2 incorrect answers.

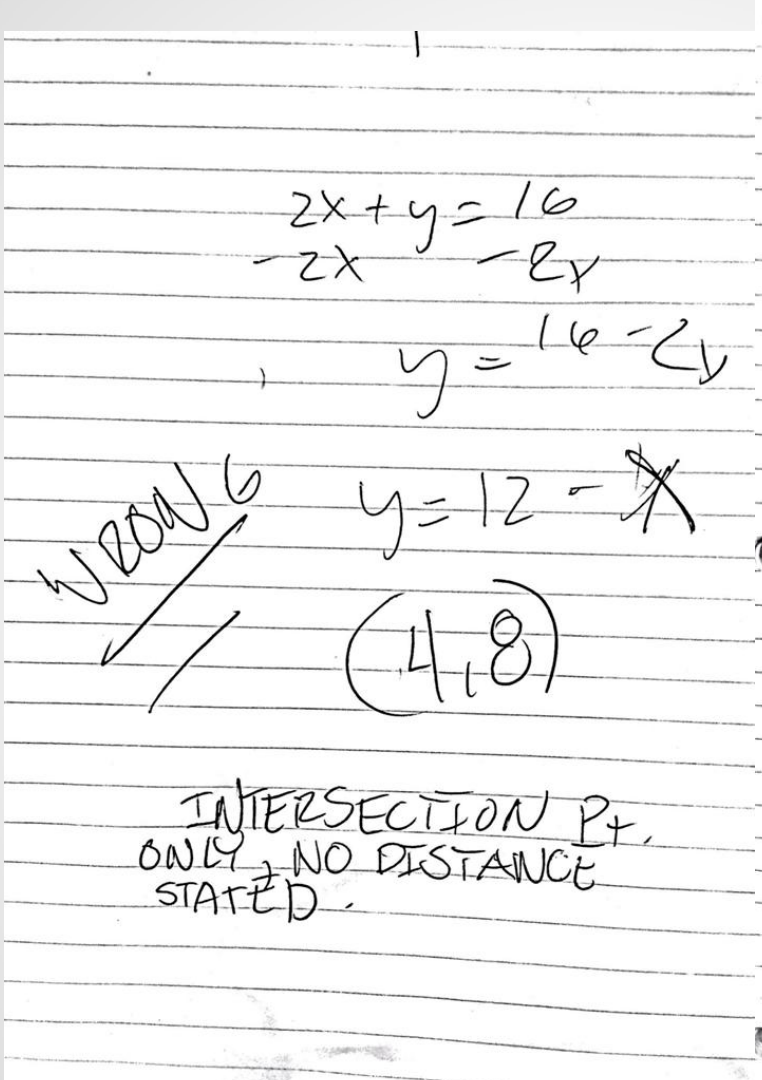
Find the distance from the origin to the point which is the solution to the system:

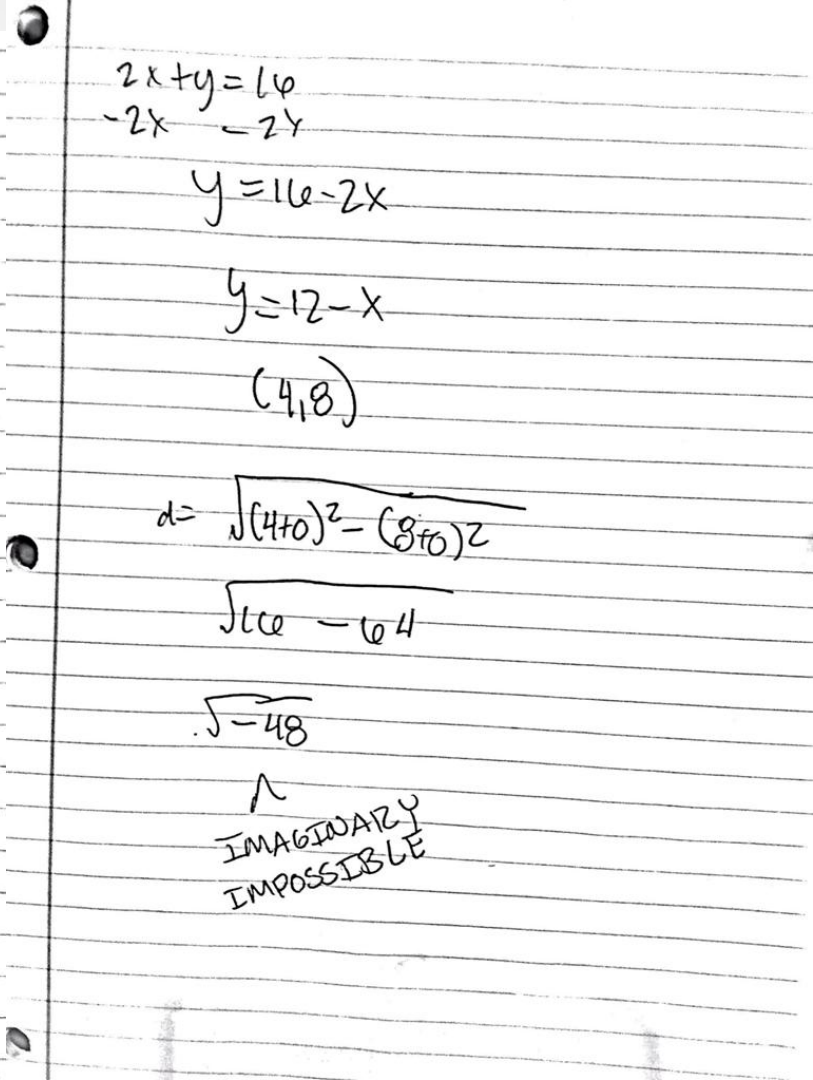
$$2x + y = 16$$
$$x + y = 12$$

The Correct Solution:



Wrong Solutions:





A little over two years ago, National Public Radio did a story about effective struggle and how different Eastern and Western attitudes are regarding learning. They told a story about Professor James Stigler, now at UCLA and his observations of a Japanese classroom. It was the culture of the classroom to just keep working until things were right. Making mistakes was part of the learning. Mistakes didn't mean that the learning was over, or that the student needed to be told what to do. Not by their teacher, nor their peers.

"I think that from very early ages we [in America] see struggle as an indicator that you're just not very smart," Stigler says. "It's a sign of low ability — people who are smart don't struggle, they just naturally get it, that's our folk theory. Whereas in Asian cultures they tend to see struggle more as an opportunity.“

James W. Stigler

Professor UCLA

What is productive struggle?

Students can engage in productive struggle when given a task just beyond their abilities. The objective is not to get to the right answer, but to engage in this struggle to advance learning and develop perseverance.

“...not to get to the right answer, but to engage in this struggle to advance learning and develop perseverance.”

As teachers, we need to let our students know that struggle is good. Not only is it good, it is necessary for learning.

2014-2015 Syllabus

"*Participation in this class is a requirement. You will be called on, quite often, to answer questions, contribute to solving a problem or to comment on another student's work. There will be times when you feel that your contribution is not correct. You may feel embarrassed to present your work to the class. You may be thrilled to be the first one to answer. Regardless of whether your answer is right or wrong, I ask that you willingly contribute to your class. I guarantee that if you made a mistake, someone else made the same one. If you have the right answer, I challenge you to reflect on an answer that someone may have arrived at, albeit incorrectly.*"

So how did things go?

Remember these kids? The ones who always were able to find the answers? They still were finding the answers.

But so were the others. :)

How does this look inside the classroom?

Find three consecutive even numbers whose sum is 432.

Find three consecutive even numbers whose sum is 432.

After answers are provided, I like to give students a minute or two to reflect on what is posted on the board. I ask if anyone wants to change his or her answer.

71, 73, 75

142, 144, 146

143, 144, 145

Find three consecutive even numbers whose sum is 432.

71, 73, 75

142, 144, 146

143, 144, 145

What started to happen, after I allowed them to get answers “wrong” and then fix them, was students were not only volunteering what they came up with, they were not hesitating to ask questions as to why other answers were presented. They were asking questions, defending their own thoughts and and were not afraid to make changes.

“Kapur has identified three conditions that promote a beneficial struggle. First, choose problems to work on that “challenge but do not frustrate.” Second, provide learners with opportunities to explain and elaborate on what they’re doing. Third, give learners the chance to compare and contrast good and bad solutions to the problems.”

http://anniemurphypaul.com/2014/02/when-and-how-to-let-learners-struggle/#

Ways to Provide Opportunities for Productive Struggle

1. Let your classroom be the place for your students to make mistakes!
2. Allow for time to reflect on answers.
3. Provide opportunities to share out with other students.
4. Ask students if they want to “change their solutions” after they reflect or discuss their work.
5. Have students write out an explanation of their answers. This is powerful even if a student is just jotting down notes next to his/her work.
6. Remind students to ask themselves “did I answer the question” and review their work.
7. Whenever possible, provide students with the opportunities to exchange work and critique their peers.

A quick math problem:

With your table, or the persons next to you, find the correct solution and one wrong solution to the following problem. You must be able to explain what mistake a student would make in finding your wrong solution.

Remember, one correct and one mistake:

If $f(x) = \frac{5x+2}{3}$, what is the y-intercept of the graph of $f^{-1}(x)$?

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coordinated achievement