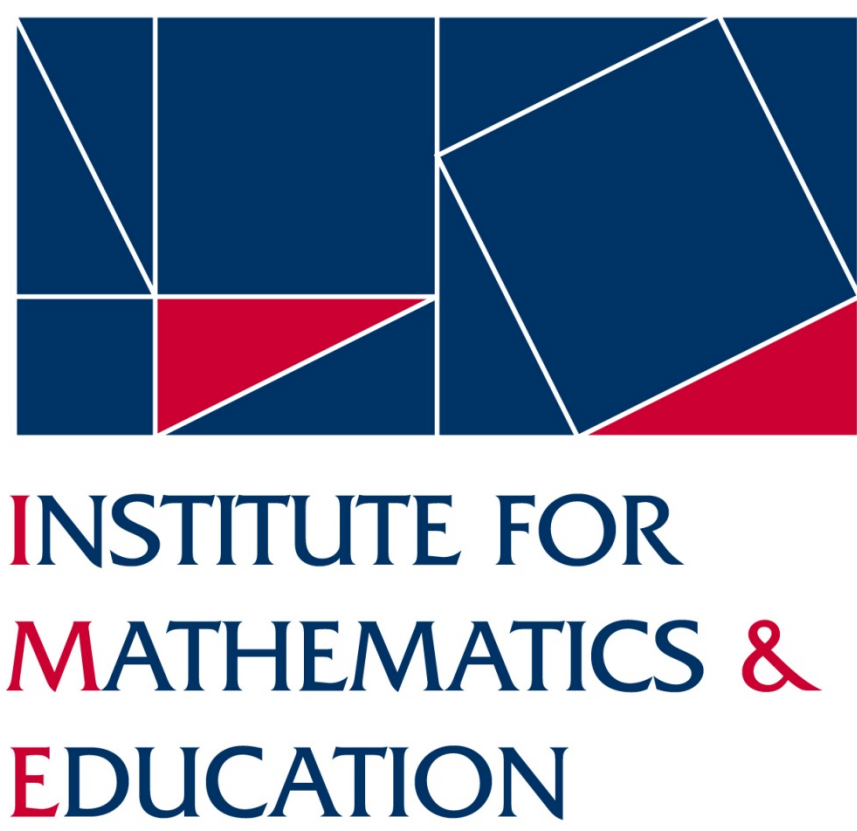




Problem Solving At Tucson High

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Grad Student: Matt Thomas



Problems of the Week

Problems of the week are non-traditional problems which encourage students to think about mathematical questions from new perspectives. Problems are given on a weekly basis and students write responses which describe their ideas and thoughts as well as their answers. Students have also read and responded to articles about issues in modern mathematics.

Examples of problems of the week:

As you may have heard, (if you have ever read The Princess Bride by William Goldman) the Dread Pirate Roberts takes no prisoners! Well, he never takes prisoners unless he plans on retiring, in which case he kills all but one. The one spared becomes the new Pirate Roberts and the old retires. This tradition cuts down on the political rat race of acquiring a new captain. You might be wondering how a pirate would choose his replacement, because, well, in case they attack your ship, it would be better to be the new Dread Pirate Roberts than dead. It just so happens that the Dread Pirate Roberts just rounds up all the prisoners and kills every other one until only one person is left alive (he spares the first, kills the second, spares the third, kills the fourth and so on around the circle until only one is left standing). Now it is safe to take that cruise you've been dreaming of. There are 100 people on the ship so if the Dread Pirate Roberts just happens to come along, in which position should you stand in order to not be killed and become the new Dread Pirate Roberts? Is there a way to predict what is the safe position given any number of people on the boat?



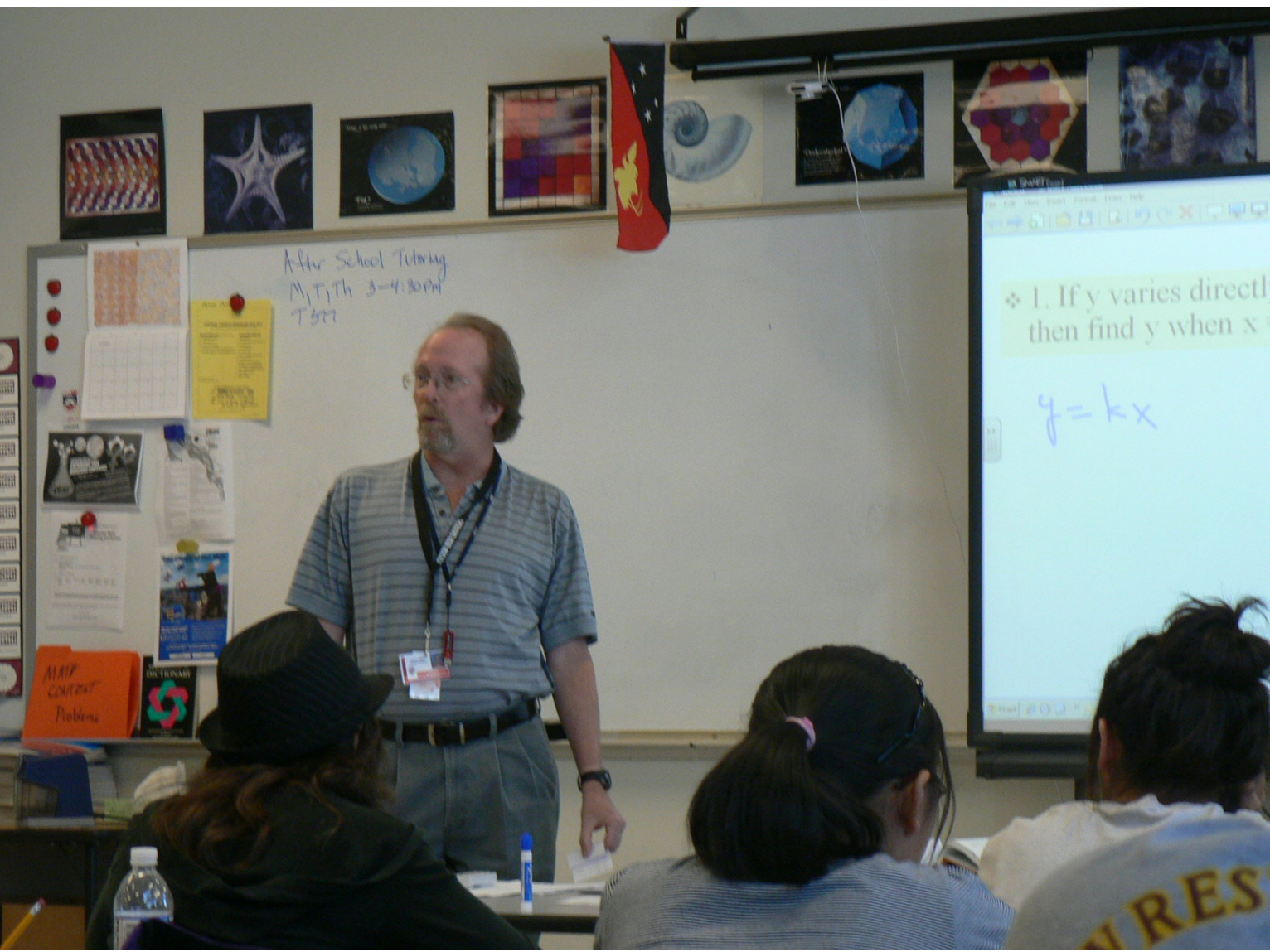
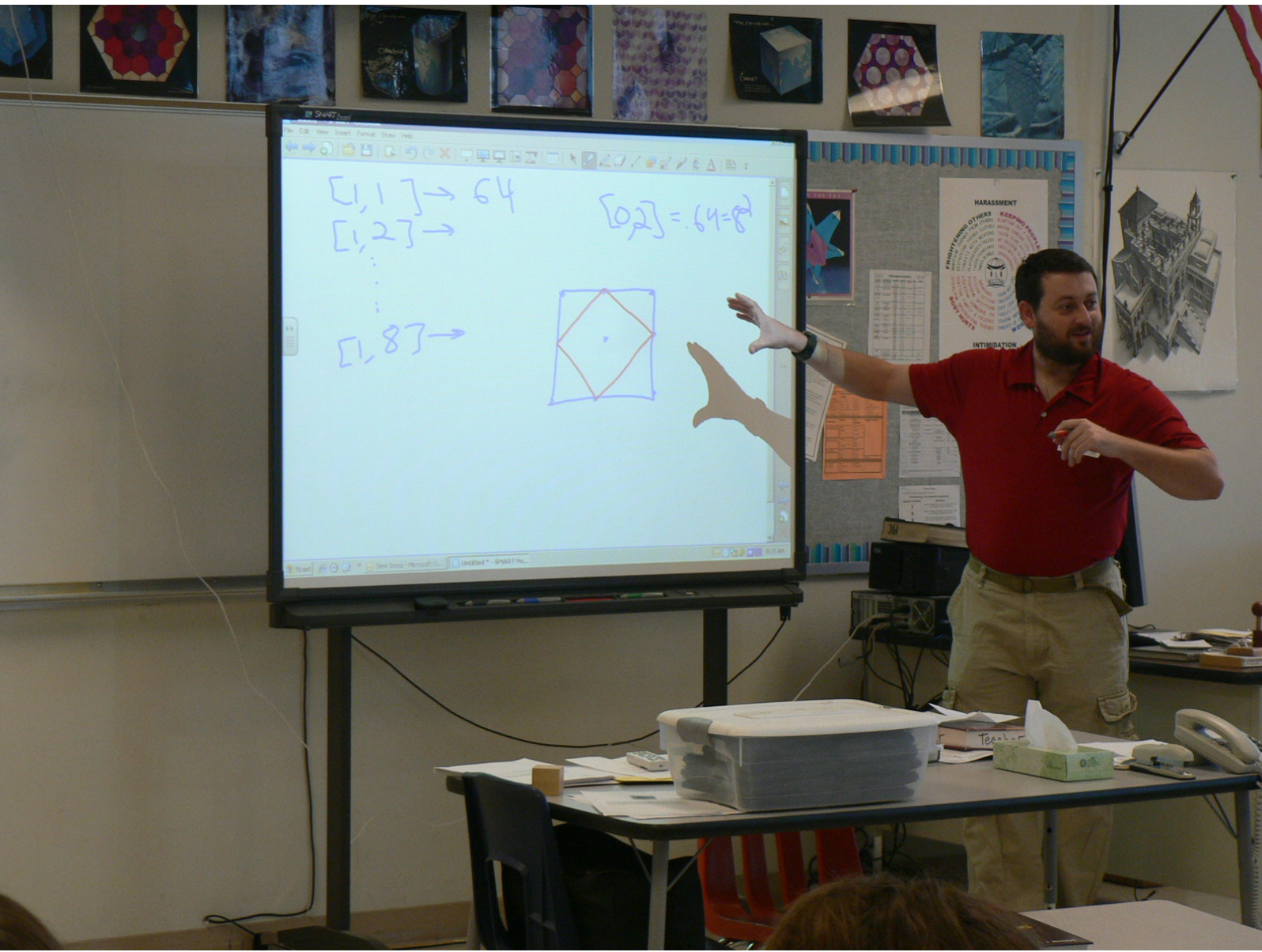
How many squares can be drawn by connecting dots in a 3 x 3 grid? a 4 x 4 grid? a 5 x 5 grid? Can you find any patterns? Can you predict how many squares there would be in a 10 x 10 grid? Can you generalize to any size grid?

A certain fast food restaurant sells chicken nuggets in boxes of 6, 9 or 20. If you want 15 nuggets, you can order a box of 6 and a box of 9. If you wanted 21 nuggets you can order 2 boxes of 6 and one box of 9. Obviously if you only want 4 nuggets you have a problem, likewise if you only want 10 nuggets. What is the largest number of nuggets that you can't make with combinations of 6, 9 and 20?

Three families get together for a party. The Jones family has five members, the Gonzalez family has three members and the Doe family has 4 members. As they meet, they shake hands. If everyone shakes hands with everyone else at the party, how many handshakes happen? If everyone shakes hands with everyone else at the party except for other family members, how many handshakes happen?

Find seven different positive unit fractions whose sum is one.

$$\frac{1}{a} + \frac{1}{b} + \frac{1}{c} + \frac{1}{d} + \frac{1}{e} + \frac{1}{f} + \frac{1}{g} = 1$$



POW #5

In this problem of the week we had to find the probability of getting a car when it is behind one door out of three. After your original guess and the host exposes one door that doesn't contain the car behind, you have the option of staying with your original guess or switching to the other number. According to the article, many people thought it was reasonable that it didn't matter whether you stayed or switched because either way it's a 50-50 chance, however this has been proven incorrect. The first person to question the 50-50 shot was Marilyn Vos Savant who figured you were more likely to win by switching, basically two to one. Many people disagreed with her, but through experiments most have come to accept. The only way this seems to change is if Monty Hall doesn't know where the car is, which could affect the door he opens up.

The first thing that ran through my mind when I finished the article was 'ow'. It makes sense while reading it, and even more so with the visual, but my mind wants to revert to my original opinion I had before the article and I have issues getting reality to process. After reading it a few times, I think I understand it clearly but it blows my mind how it works. If I understand this correctly, there is only one in three chances that the player will win if they don't switch. On the other hand, if one of the other ones is chosen (seen as red on the visual) the player will want to switch. Now, there are more red than blue, so someone is more likely to pick the red – the wrong choice – and when the other wrong choice is eliminated, then it's more likely that the car is the door not chosen by either player or host.

Math Circle

"Mathematical Circles are a form of education enrichment and outreach that bring mathematicians and mathematical scientists into direct contact with pre-college students. These students, and sometimes their teachers, meet with mathematical professionals in an informal setting, after school or on weekends, to work on interesting problems or topics in mathematics. The goal is to get the students excited about mathematics by providing a setting that encourages them to become passionate about mathematics." - The National Association of Math Circles

Example Problems:

Add a 1 foot segment to a band around the equator. How far off the earth is the band now?

How many numbers contain the digit 3?



Show that in any group of 6 people where pairs are either friends or strangers, there will exist a triangle of friends or a triangle of strangers. If 17 people are gathered where pairs are either friends, strangers, or enemies, show that a triangle of one of these types must exist.

Card game - teams of three win or lose together. Each person is given a card. On a count, everyone who chooses to must guess the color of their card. Everyone who guesses must be correct to win. If anyone is wrong or no one guesses, the team loses. No communication is allowed. What is the best strategy for a team?

Problem of cutting a cake fairly. With only a knife (no rulers or measuring tools), how can one cut a cake so that each person will have an equally beneficial strategy for getting a fair share of the cake?

Student Feedback

"I most certainly believe the class has benefited from [Mr. Thomas'] presentations. Each of them provided me with information on subjects of all sorts. There were things he discussed that I had never even heard of before!"

"P.O.W.'s [problems of the week] are the hardest part of the class for me. If I force myself to sit down and do them, it can be satisfying to figure them out and get the right answer...Finally, hearing Mr. Thomas giving us the solution on Friday is also satisfying. I like Mr. Thomas' lectures, because it's interesting to see real-world math."

"The best thing that I like about this class is that Mr. Thomas was there to help with problems of the week. I liked how as a class we would work together to find a way to start the problem of the week...Also the fact that we go over previous POWs is very helpful as well."

"I would have never thought that a guest speaker for math would be interesting. Learning about mathematicians definitely changed my view of them."

"Mr. Thomas is funny, but at first he seemed a little shy. I think we benefited from Mr. Thomas' presentations. He provided insight in a rarely talked about career."

