Presentation

FULL DETAILS AND TRANSCRIPT

Problem Solving in Algebra

Castle View High School, Colorado • November 2008

Topic: National Math Panel: Major Topics of School Algebra

Practice: Topics of Algebra

Highlights

- Using polynomials to put pictures and letters on a calculator
- Different forms of equations of lines
- Limiting the domain for polynomial functions
- Difficulties students have with problem solving in Algebra
- Developing proficiency in problem solving
- Approaches to working with students on problem solving
- Modeling problem solving steps and writing about problem solving

About the Site

Castle View High School

Castle Rock, CO

Demographics

85% White

9% Hispanic

2% Black

2% Asian

1% Native American
7% Free or Reduced-Price Lunch
2% English Language Learners
9% Special Education

Castle View High School operates on a rigorous academy model designed to provide smaller learning communities within the high school. The Math, Science, and Engineering Academy offers innovative courses in science, technology, engineering, and mathematics with a supportive staff helping all students achieve their potential while acknowledging each individual's learning style. Features of mathematics instruction at Castle View are:

- Integration of mathematics content within mathematics and across other subjects;
- Implementation of technology into instruction;
- Incorporation of problem solving into each level of mathematics; and
- Accessibility of algebra to every student.

Full Transcript

Slide #1

Welcome to Problem Solving in Algebra.

Slide #2

Hello, my name is John Lawless. I'm the Math Content Lead here at Castle View High School in Castle Rock, Colorado, and we are part of the Douglas County School District. I think a lot of the difficulties that I see students having in solving problems with Algebra are looking at the initial problem and being able to put it into a math sentence or be able to put into math variables. Many times the problem is difficult because they don't have a picture. They can't visualize what's going on, so I'll have them either draw a diagram or put it on a graph.

Slide #3

The class we are going to see today is on linear equations—the graphing and all. We have already spent time reviewing linear equations. We've defined a polynomial in general terms. The kids have an idea of what a polynomial is, and we've touched on monomial, binomial, and trinomial and those terms. That's not really the goal right now. We are really focusing just right now on the linear equations. And so we are going to start simple today and we are going to do a birdhouse, and this is leading into the letter or the word WAX

with linear equations, and then we are going to do WAX again, but we are going to use polynomials where they have to make a W using a fourth degree polynomial, and the letter A is a quadratic that has been reflected or flipped so the negative A value, and then the X is two cubics. So that's our goal that we are leading up to. Can they represent things on a graphing calculator?

Today is a very introduction to that, and they are starting to see how to limit their domain on the calculator, how to make a segment on the calculators to input endpoints on your polynomial, and there is specific technology or specific algorithms you have to do on your graphing calculators to do that. So they'll also learn the beginnings of that today too.

Slide #4

Students are given a birdhouse, it's made by linear equations and they are going to have to put that on their graphing calculator and where do they start. And we lead up to that by previously addressing equations of lines, reviewing that, reviewing the two forms, and this is leading into the transformations of equations. How do you get kids to practice transforming equations in different forms so that they are useful? We are going to look at slope intercept form, and they see that's nice and useful for the Y intercept, but if you don't have real nice Y intercept sometimes it's more useful to be in factored form, or what we will call X intercept form. And if they can see the difference between the two forms, sometimes one form is more helpful than the others. And in doing this birdhouse problem today some kids just like slope intercept, and some kids will just do the factored form. And my goal is that they can connect the two and see that if you are given this problem—you got to make a birdhouse on the calculator—how do you do that? Let them explore with their partners first, and let them try stuff, and then as a class we will come back together and share ideas.

Slide #5

The way that we try to approach students developing proficiency in areas of, say, translation, where they are going to take a problem from the verbal and put it into the equation, make meaning of it. One of the best ways that I found, one of my philosophies that I truly try and take and encourage others to take, is students don't just learn math by doing, they learn by discussing what they have done. And when students are talking about the mathematics they may get an idea from a partner on how to translate it from the verbal into the equation part. And so if they can see it presented by another student, if they can really get a picture, they can get an understanding—a visual representation of what's going on, it helps them make meaning for the translation part.

Slide #6

The modeling of problem solving that I do after the students have struggled with it a little bit or after they have tried it, I will put up on the board, and say, “Here is one method that works, and here is a technique. Now we will show you a skill. Some of you were asking, ‘How do we do this?’ or ’How can I do this step in this problem solving?’” So what I will do in front of the class is on the board I will show them and model for them, “Here are the steps that I would take, and here is the most efficient that we have seen in mathematics that works. If you do these steps…” And I will do a model to write in and go step by step by step. If they have already explored it a little bit, I will try and honor the techniques they have used and then show them another technique by actually modeling it.

When I am modeling, think-alouds come up quite a bit. As I am writing on the board, I am saying, “Boy, what can I do here? Here is what I am thinking in my head.”—kind of the metacognition piece that I use as a teacher going, “Here is what I am thinking here. I am not sure...” For example, say the degree is two, “I know I need two solutions or two zeroes, but I am not seeing them on my graph. Why is that happening?” And then I can go back and walk them through how I would check and see why my graph is not agreeing with what I know should happen from the equation, per se. I think that metacognition piece is really big for them to see what I am thinking, and when I make a mistake usually it turns into a really good thing because I can say, “Boy, that shouldn’t happen. Why is that happening?” If I say it, I have to remember to say that out loud so the students can hear that and go, “Wow, he has those same struggles,” or “I had that same issue, and now I see what the process is he would use to solve that problem.”

Slide #7

When students can take a big problem that is not like stuff they specifically have seen, but it addresses similar skills that we have covered through the whole book or whatever we are at in the year, “Can you take all the skills we have done, and can you solve this problem?” When they can do that individually, in pairs, or in a team, then I can start to see, “Wow.” And when I can give them any problem, and they can do problem solving, that’s the ultimate goal. And that’s a hard step to get to, but that’s when I know that they really have it.

Slide #8

To learn more about Problem Solving in Algebra, please explore the additional resources on the Doing What Works website.