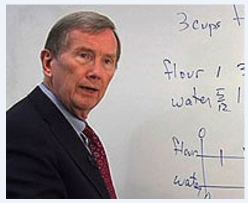
DOINGWHATWORKS

VIDEO
4:40 min

Full Details and Transcript



Ratio, Rate, Proportion Problems

W. James (Jim) Lewis, Ph.D.

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Topic DEVELOPING EFFECTIVE FRACTIONS INSTRUCTION FOR K-8

Practice RATIO, RATE, PROPORTION

Highlights

» Dr. Jim Lewis describes a set of problems involving the ratio between water and orange juice concentrate. He shows a ratio table with different amounts of water and concentrate to help address varied questions on topics such as variations in the total quantity to be made.

» For a recipe involving flour and water, Lewis shows how to build a ratio table to figure out various proportions of each ingredient.

» He also shows how to adapt the ratio table using "going by way of one."

» Then he demonstrates how to use the concept of "going by way of one" using two number lines to represent the quantities of each ingredient.

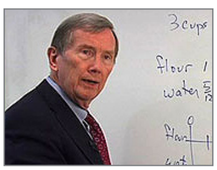
» He emphasizes the importance of using labels to be sure the correct ratios have been set up.

» Dr. Lewis emphasizes why it is important to show a problem worked out in more than one way.

About the Interviewee

W. James (Jim) Lewis, Ph.D., is the Aaron Douglas Professor of Mathematics at the University of Nebraska-Lincoln (UNL) as well as director of the school's Center for Science, Mathematics, and Computer Education. Dr. Lewis is principal investigator for two National Science Foundation Math Science Partnerships, NebraskaMATH and the Math in the Middle Institute Partnership. He was chair of the Conference Board of the Mathematical Sciences committee that produced *The Mathematical Education of Teachers* and co-chair of the National Research Council committee that produced the report *Educating Teachers of Science, Mathematics, and Technology: New Practices for the New Millennium*. Dr. Lewis was also co-principal investigator for Math Matters, a National Science Foundation grant to revise the mathematics education of future elementary school teachers at UNL.

Full Transcript



00:00 I'm Jim Lewis. I'm a professor of mathematics at the University of Nebraska-Lincoln. Over the past year, year and a half, I have worked with the fractions panel to create a fractions practice guide for Doing What Works.

Making Orange Juice

00:22 Most of us buy orange juice by buying frozen concentrate. Almost always the instructions say use one can of concentrate and three cans of water. What if we wanted to make enough orange juice that we use four cans of concentrate? Or let's suppose we started with 15 cans of water, and how much concentrate should we put in to go with it? Or what if you want to make 12 cans of orange juice? How much concentrate should you use? How much water should you use?

Recipe

01:03 Let's work through a problem that involves a recipe, so that's something that involves a ratio. Perhaps we want three cups of flour and one and one-quarter cups of water. We might start analyzing the situation by building a ratio table. So we log in three cups of flour and one and a quarter cups of water. If we make it again, that's six cups of flour two and a half cups of water, then nine cups of flour and three and three-quarter cups of water. If we by chance were asked about five cups of water matching up with 12 cups of flour, that would show up in our ratio table. What if we wanted to use ten cups of flour? Then our ratio table is not going to all that automatically give us an answer.

01:54 We could adapt our ratio table doing what we call "going by way of one" to put in one here. That forces us to think. We have divided three by three to get one. Let's divide one and a quarter, or five-fourths, by three to get five-twelfths. Then if we say this is a multiple of ten to get to here, we want to multiply by ten to decide what goes right there: 5/12 x 10 = 50/12 = 4 1/6.

02:28 Using our ratio table, we are working with proportions. We could do the same thing with a number line. We could put flour here, water, zero is our starting point. And we might locate three—three cups of flour, one and one-quarter cups of water. Now, the interval from zero to three, we think of breaking it apart: Here is two; here is one. And so, to stay in proportion we have got to take this amount of water—whatever number we put right here—take one-third of it right here. If this is five-fourths, we want five-twelfths here. So out here in our number line somewhere we find ten, and we are interested in what number goes with it. We see a multiple of ten here, we need a multiple of ten here. We got fifty-twelfths, five times ten being 50, so that we know that our answer is going to be four and one-sixth.

03:32 Now both of these situations are essentially the same as the ratio: three is to one and one-quarter as ten is to x. But it would really help if we put in a unit so that we know we set up the correct ratio: flour to water, flour to water.

03:54 The students need to see one problem worked in more than one way so that they see that both techniques work. They are going to gain a sense of which problem works—which approach works best for them most often, but it's never going to be a completely clean strategy, "In this situation, you should always do the following." And that's part of the nature of mathematics, that it involves the reasoning and judgment, and so the person with more experience is going to do a better job of picking the better tool out of their toolbox.