Chapter 18 - Proportionality and Percentages

Per Problems 6 minutes and 54 seconds

Proportionality is one of the most important concepts in mathematics in real life applications and yet there's evidence that many adults have real difficulties in handling the concept of proportionality. It's very important for example in healthcare, where we rely on healthcare practitioners to get their calculations correct. Recently I wrote a book with a colleague called Paul Warburton and the book was called *Mathematics Explained for Healthcare Practitioners.* And I'm going to share with you a few examples of proportion questions that we've used in that book just to illustrate how important this principal is in real life situations.

So, I want to…you to imagine that we have to provide an infusion for a patient, an infusion delivers a certain volume in millilitres of fluid in a particular time in hours. So here we have two variables, these variables are in proportion so for example, if a volume of two hundred and fifty millilitres is delivered in two hours, then seven hundred and fifty millilitres-three times as much-will be delivered in six hours, three times as long. That's how proportional relationships work. Now look at the four numbers we have here, and you can analysis them mathematically in four different ways. You could say that the relationship is that you multiply the top number in a column by three to get the number underneath. Two hundred and fifty multiplied by three to give seven fifty. Two multiplied by three to give you six. Therefore, you could also say that you divide the bottom number by three to get the number above it. Seven hundred and fifty divided by three takes you to two hundred and fifty. Six divided by three takes you to two.

But you could also look at the relationships along the rows. Going from right to left, the relationship is multiply by a hundred and twenty-five. Two multiplied by a hundred and twenty-five is two hundred and fifty and six multiplied by a hundred and twenty-five is seven hundred and fifty. And this means you can go the other way along the rows dividing by a hundred and twenty-five. Two hundred and fifty divided by a

hundred and twenty-five is two, seven hundred and fifty divided by a hundred and twenty-five is six. Whenever you have a proportional relationship, there are always these four possible ways of identifying the mathematics involved.

So, lets have a look at another example. I'm imagining now that we have a drug that's being delivered in a suspension that's in fluid form-and a particular volume of the suspension in millilitres contains a particular dose of the drug in milligrams. So, for example, five millilitres might deliver two hundred and fifty milligrams of the drug. The question we might be trying to answer is what volume do we need to deliver a dose of a thousand milligrams. So, we have three numbers given to us and we have to find this fourth number. Proportionality problems always have that structure. Two variables, four numbers, three of which you know, one of which you have to find. We then look for what is the easiest relationship between the numbers in the table to work out the missing number. Now looking at that I think the easiest thing to do is to look at the relationship down the columns. To get from two hundred and fifty to a thousand, we multiplied by four. So, we do the same to five multiply by four and we get the result twenty millilitres required of the infusion to deliver a dose of a thousand milligrams.

Here's another example, another drug in which the suspension of five millilitres contains two hundred milligrams of the drug. And we want to deliver one hundred and twenty milligrams. What volume of the suspension do we need? Well, this time it looks to me as thought the easiest relationship is along the rows. To get from five to two hundred, you multiply by forty. Or to get from two hundred to five, you divide by forty, so we divide the hundred and twenty by forty and we get the missing number three, a volume of three millilitres delivers a dose of a hundred and twenty milligrams.

One last example, now we have another suspension if five millilitres contains a dose of a hundred and fifty milligrams, what dosage would we deliver in a volume of twelve millilitres? Now what would be easier to look at the five and the twelve or the five and the hundred and fifty in order to find this missing number? I think it's the left to right relationship which looks easiest to me. Multiply by thirty, multiply five by thirty and you get a hundred and fifty. So, we just multiply the twelve by thirty to get the answer

three hundred and sixty milligrams in twelve millilitres of the suspension. In practice you find that many problems of proportion can be solved like this informally by exploiting the most obvious multiplication or division relationships between the given values of the variables.