LESSON 131 – Proportions

This lesson introduces the concept of proportions.

- It is not uncommon for students (and adults!) to think that a ratio and a proportion are synonyms. They are not!
- **A proportion is defined as the equality of two ratios.**
- Students have just seen that two ratios are equal if the fractions shown by the two ratios are equivalent fractions.
- **The only way a proportion can exist, then, is if the fractional forms of the two ratios are equivalent fractions.** This fact is how we test if two ratios are proportional.
- To state it another way, just because two ratios are described, doesn't mean they are proportional.
- Besides the test of equivalent fractions, the two ratios MUST compare related objects. For example, suppose the ratio of dogs to cats on a farm is 5 dogs to 2 cats, and the ratio of apple trees to orange trees on the farm is 10 apple trees to 4 orange trees. The fractional forms of these two ratios are equivalent ($^5/_2 = {}^{10}/_4$). But the relationship between the animals has nothing to do with the relationship between the trees. Suppose the number of animals changes. Does this change the number of trees in the orchard? No, because they are not related objects.
- The way a proportion is expressed is similar to ratios. The symbol for a proportion is two colons side-by-side.
    - In symbol form we write each ratio as usual, and then put the :: sign between the ratios as with, 2 : 4 :: 3 : 6.
    - In word form we say "2 is related TO 4 just as 3 is related TO 6."
    - In fraction form we write $^2/_4 = {}^3/_6$.
- We can write the symbol or notation form for any given ratio in general terms as $a : b :: c : d$, where a is the first term, b is the second term, c is the third term, and d is the fourth term in the proportion; a and b describe the first ratio, and c and d describe the second ratio.
- Given the placement of the terms in the proportion, they have special names.
    - Because b and c are in the middle, they are called the **means** of the proportion.
    - Because a and d are the terms on either end of the proportion, they are called the **extremes**.
- **One of the properties of a proportion is that the product of the means always equals the product of the extremes.** In other words, $b \cdot c = a \cdot d$.
- We then show students why this is true.
- If two ratios are given and this property is not true, then the two ratios do NOT form a proportion.
- The first part of the exercise has the student identifying the four terms, the means, and the extremes of pro-portions written in all three formats. This lets you see if your student can identify the necessary vocabulary words.
- The second part of the exercise compares two ratios (in the various formats) and students have to determine if the they form a proportion.
- If your student has trouble with the exercise, be sure to review it before moving ahead. The student will need to be able to identify the terms and use the relationships within a proportion in the lessons that follow.

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