

# Understanding Math

## Southern Nevada Regional Professional Development

### Proportional Reasoning

Proportional reasoning is an important skill for students to learn. It is a required tool for higher-level mathematical thinking, as well as to survive and compete in the world. However, imprecise use of language interferes with the development of proportional reasoning and leads to misconceptions and misunderstandings later in a student's life. In this issue *Understanding Math*, we'll look at how inaccurate language can affect proportional reasoning.

Two phrases that are confused are "times as much as" and "times more than". It's not uncommon to hear people using those two expressions interchangeably, but they mean different things.

- Eighteen is **six** *times as much as* three.
- Eighteen is **five** *times more than* three.

The phrase ***times as much as*** indicates a comparison as a ratio. The ratio between eighteen and three is 6 to 1. Essentially, *times as much as* could be simply thought of as *times*. Eighteen is six *times* three.

- Eighteen is **six** *times as much as* three.
- Eighteen is **six** *times* three.

***Times more than*** indicates that something is added on, or that we are speaking of a relative difference. The key words are "more than." Eighteen is fifteen more than three. That is, three has had fifteen added to it. Fifteen is five times three, so eighteen is five *times more than* three.

- Eighteen is **fifteen** *more than* three.
- Eighteen is (**five times three**) *more than* three.
- Eighteen is **five** *times more than* three.

*Times as much as* and *times more than* are often confused and interchanged. Another commonly used phrase, however, is simply wrong. That is the phrase, "times less than."

- Three is **six** *times less than* eighteen. (?)

It's a puzzle as to where this misstatement originated, but one may suspect it has something to do with people's aversion to fractions. If we intend to make a ratio comparison, then we should say that three is one-sixth (*times*) *as much as* eighteen. If the goal is to show a reduction, because of the words "less than," then we should say that three is five-sixths *times less than* eighteen. That's a mouthful and has a non-unit fraction, which may be why people don't say it. (Actually, *negative ninety* is six times less than eighteen.)

- Three is **six** *times less than* eighteen. **Wrong!**
- Three is **one-sixth** *times as much as* eighteen. **Correct!** (But we usually don't say "times.")
- Three is **five-sixths** *times less than* eighteen. **Correct!** (But we rarely say this.)

Most of this imprecise language occurs in our non-academic lives. It is heard on the news, in advertising (print and otherwise), and in everyday conversation. Often we know what people mean to say, but our kids may not. It is incumbent upon us to show them how to be critical thinkers when they hear mathematical language used loosely.