Mathematics and meaning in introductory physics[1]

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The degree to which many introductory physics students struggle with math is sometimes surprising. Even experienced instructors sometimes find themselves wondering what exactly students learned in all of those math classes. In this talk I will highlight the ways that mathematics as it is used in physics courses is different from what students have seen in math classes. I will present data from a study on student use of proportional reasoning in physics that suggests that many students have become proficient with mathematical procedures without considering the meaning of these procedures, and without a larger sense of what these procedures are for. Our goals for using mathematics in physics as a way of making sense of physical phenomena are different from the goals of mathematicians when they use the same procedures. As a result, physicists have an important role to play in fostering a flexible and generative use of mathematics as a tool for investigating and describing phenomena. To do this effectively, we first need to understand how physicists' mathematical habits of mind are different from those of students entering our courses.