Beyond the Number Line: Coordinate Systems and Vector Arithmetic

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Physics takes place in three-dimensional space where many fundamental quantities are represented by vectors, but instead of teaching "new math," how can the treatment of vectors be best linked to concepts already present in a student's math background? One connection for students lives in the revitalization of the long abandoned number line. Students have not dealt with them in years, but the tidy row of numbers that was pasted high on the wall in every elementary classroom forms the very foundation of a one-dimensional coordinate system. Constructing coordinate systems from nothing and then making measurements within them are the processes that allow the quantification of observations, an essential tool for any student of physics. I want my students to realize that arithmetic operations *change* things and understanding physics is understanding of stretches, sides and spins applied to objects in our world. Because of this, we will use transformations to interpret vector mathematics and, by extension, introductory physics. This is designed to be the second unit for my 11th grade General Physics and AP Physics 1 classes in a school where physics is the required science course for all juniors.

(Developed for AP Physics I and Physics, grade 11)