A Variation on Temperature Conversion

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Students of physics frequently have difficulty remembering the correct form of the standard temperature conversion formula between Fahrenheit and Celsius. Students often try to recall the equation from rote memory and think along this line: "Let's see, does one add 32 or subtract it from F, or is it C, then multiply it by 5/9, or is it 9/5, in order to convert?" Physicists will, if necessary, reason out the formula from a basic understanding of the relationship between the Fahrenheit and Celsius temperature scales. The physicists' line of reasoning might be based upon knowledge of the fact that 212°F corresponds to 100°C and that the unit sizes differ by a factor of 9 to 5, respectively. The reasoning could be expressed something like this: "If one takes 212, subtracts 32, and multiplies by 5/9, one gets 100. Or in more general terms, $\frac{5}{9}(F - 32) = C$."

The late Paul Mahle of Immaculate Conception High School in Celina, Ohio, used to teach a way of remembering temperature conversion based not upon the above boiling-point correspondence, but upon the fact that both scales measure the same temperature at –40°. That is, –40°F corresponds to –40°C. By reformulating the traditional conversion formula, one can arrive at what is for some a more memorable system for converting between F and C. Consider the following algebraic manipulation:

$$\frac{5}{9}(F - 32) = C, \qquad (1)$$

from which one can algebraically derive

$$5(F + 40) = 9(C + 40). \qquad (2)$$

Now, two alternate forms of the equation can be written:

$$\frac{5}{9}(F + 40) - 40 = C \text{ and } \frac{9}{5}(C + 40) - 40 = F, \text{ (3)}$$

from which a more general rule can be derived: "Add 40, multiply by 5/9 or 9/5, and subtract 40."

The only thing one needs to remember to use this strategy is that, because 180 Fahrenheit units correspond to 100 Celsius units, one must multiply F units by 5/9 before subtracting 40 and multiply C units by 9/5 before subtracting 40. In the author's experience, students appear to more readily remember this form of the conversion equation.