

Alice in Wonderland's Multiplication

Thierry Desrosiers

Alice took up the fan and gloves, and, as the hall was very hot, she kept fanning herself all the time she went on talking. "Dear, dear! How queer everything is today! And yesterday things went on just as usual. I wonder if I've changed in the night? Let me think: was I the same when I got up this morning? I almost think I can remember feeling a little different. But if I'm not the same, the next question is 'Who in the world am I?' Ah, *that's* the great puzzle!" And she began thinking over all the children she knew that were of the same age as herself, to see if she could have been changed for any of them.

"I am sure that I'm not Ada," she said, "for her hair goes in such long ringlets, and mine doesn't go in ringlets at all; and I'm sure I ca'n't be Mabel, for I know all sorts of things, and she, oh, she knows such a very little! Besides, *she's* she, and *I'm* I, and—oh dear, how puzzling it all is! I'll try if I know all the things I used to know. Let me see: four times five is twelve, and four times six is thirteen, and four times seven is—oh dear! I shall never reach twenty at that rate!"
—*The Annotated Alice: Alice's Adventures in Wonderland and Through the Looking Glass*. Lewis Carroll. Ed. Martin Gardner. New York: Norton, 2000, pp. 21-23.

To explain Alice's multiplication using bases, consider that Alice multiplies 4 times $(5+n)$ base $18+3n$ to find the different answers that she states in the text. When $n=0$, to get four times five equals twelve, she first converts it to base 10 which will equal 20 and then converts it to base 18 which will be 12. Then ($n=1$) she tries four times six which is equal to 24 in base 10 and 13 in base 21. She imagines repeating the same process for four times seven ($n=2$), four times eight ($n=3$), four times nine ($n=4$), and so on until four times twelve which is 19 base 39. If she went on to multiply four times thirteen in base 42, she would get 1,10.

This awareness of her multiplication changed my perception of Alice because at first I thought she was an imbecile. Now I find she is clever. She is simply using base $18+3n$. She has a bright mind.

The connection to machine arithmetic is that she is using a specific base to make her calculations. It is the same as with a computer. In computers, we only use base 2 in which the two numbers stand for *on* and *off*.

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