On My Mind

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Let's Take Another Look at Pi Day

IN OUR EARNEST DESIRE TO EDUCATE OUR students about the great importance and significance of the number π by celebrating with special mathematical activities on March 14, we just may be teaching a concept that we had not intended or that we are overlooking altogether. I am referring here to the fundamental concept of the place-value structure of our decimal number system.

To begin with, pi is an irrational number that begins 3.141592653. . . . Those numbers after the decimal point are merely the first nine digits of a theoretically infinite string of digits with no apparent pattern or repeating cycle. To bring things down to a manageable size, especially when someone is not using a calculator with a pi key, we have traditionally rounded the value to the nearest hundredth, which is 3.14. From there, we have altered that number to reflect the common style of writing dates—3/14—meaning the 3rd month (March) and the 14th day. Hence, the big day for pi is March 14.

This system seems logical until we look deeper into the matter. The tendency these days for reading such decimal numbers as 3.14 is to say "three point fourteen" or "three point one four," whereas the true pronunciation should be "three and fourteen hundredths." In the latter form, its place-value meaning is clearer, meaning that we have 3 full units with an additional 14/100 of another unit.

On the other hand, writing the 3 and 14 as a date involves two different bases. The 3 is based on the 12 *months* of the year, and the 14 is based on the 31 *days* of the month of March. It is interesting to note that although each year has twelve months, the number of days in a given month is not uniform (31, 30, 29, or 28). And as a means of measuring a quantity of time, it is not even equivalent to such mixed-base times as 4:15 P.M., indicating 4 full units of hours (base 12) *followed by an additional* 15 units of minutes (base 60). The latter case is consistent with other measurements in mathematics, such as a board that is 2 feet 5 inches long, or a newborn baby who tips the scale at 6 pounds 10 ounces. These measurements share the "addition" concept even though they have dual

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bases for their numbers. The date of 3/14 lacks this essential property if it is to be considered related to the common value of pi as 3.14.

Perhaps by now you are asking yourself, "What is the big concern here with this?" I will respond by citing a simple story problem, then showing how students might react to it.

> Randy can walk at a speed of 4 miles per hour. He needs to walk a distance of 9 miles. How long will it take him to do this?

John promptly picks up his calculator and begins pressing keys. First, he presses the 9, then the division key, followed by the 4, and finishes with the equals key. He quickly looks at the display; seeing 2.25, he proudly raises his hand and announces, "Two hours, twenty-five minutes." Of course, we gently point out to John his misinterpretation of the fact that "twenty-five hundredths," or "25/100," is really "one-fourth of an hour," which is then "1/4 of 60 minutes" or just "15 minutes." So the correct response should be "2 hours, 15 minutes." Sheepishly, John says, "Oh yeah, I just forgot."

Has that situation ever happened to you in your class? I am almost certain that it has. I have observed it many times in my career. I feel it is largely a result of our inconsistent manner of reading decimals these days. In fact, it seems that the "*N* point *M*" style is winning the battle. Therefore, we need to devote a little time in our classes to point out this distinction. What better time to do it than on Pi Day, March 14?

I would like to suggest some additional ways to observe Pi Day:

- Once a month, we could have Pi Hour; the 3 could represent the 3rd day of the month, and the 14 would be the 14th hour (2 P.M.) of that day. The only drawback is that many students do not have their mathematics class scheduled at that hour, so they would miss out on all the fun.
- Once a day, we could have a Pi Minute at 3:14 P.M.; the 3 would represent the 3rd hour after 12 noon, and the 14 is the 14th minute of that hour. However, by this time, many schools have dismissed the students to go home. Perhaps the mathematics staff could meet in the teachers' lounge and share a piece of pie and a cup of coffee. Unfortunately, it would be necessary to eat it within sixty seconds; at 3:15, it is no longer Pi Minute.
- Finally, we could have Pi Second at 3:14. The 3 means the 3rd minute after every hour, and the 14 is the 14th second of that minute. What could you do in one second? My suggestion is that the teacher could play the role of a choir conductor. As the big event approaches, he or she could raise a ruler/baton in the air and ask the students to stand beside their desks. At the proper time by the teacher's watch, the ruler is lowered and everybody calls out, "I like pi!" It would appear to me that this type of celebration has the advantage of probably reaching almost every student.

Maybe we could even find other days on which to celebrate Pi Day. If we interpret the additive aspect of the value 3.14 as 3 full months, then have the 0.14 pass to the following month ($0.14 \times 30 = 4.2$, rounded to 4), we obtain April 4 as Pi Day. Or convert pi to other bases. In base 5, it is 3.0323322**143**03. . . . Rounding this number to two places after the point yields 3.03. This number tells us that when converting by the dual-base method, March 3 is Pi Day (base 5). For those who love number trivia, notice the 143 embedded in the sequence of digits. If we write it as 14/3, we have 14 of March as it is commonly expressed here in Latin America, where I live. I can only surmise that may be the reason I do not hear any talk about celebrating Pi Day in our schools. But this alternative method of writing dates might suggest that we observe Pi Day on July 22, because the reverse notation, 22/7, doubles as the famous fraction form of pi. (In fact, some pi celebrations do just that, calling July 22 Pi Approximation Day.)

Please do not interpret this little essay as advocating that we *not* celebrate Pi Day on March 14. It is just to show our students the mathematical liberty that we are taking when we convert 3.14 to 3/14, thus making them more aware of the essential difference in our place-value notation system and dual-base systems. Then maybe John will not make the error that he committed in the problem about Randy's walking time.

(If this year's Pi Day on March 14, 2002, is written as 31402, then those digits in that order can be found embedded in pi beginning at the 219,770th position. The Web site for finding digit strings in pi is www.facade.com/legacy/amiinpi/.) ▲