Feynman Point and more about Pi

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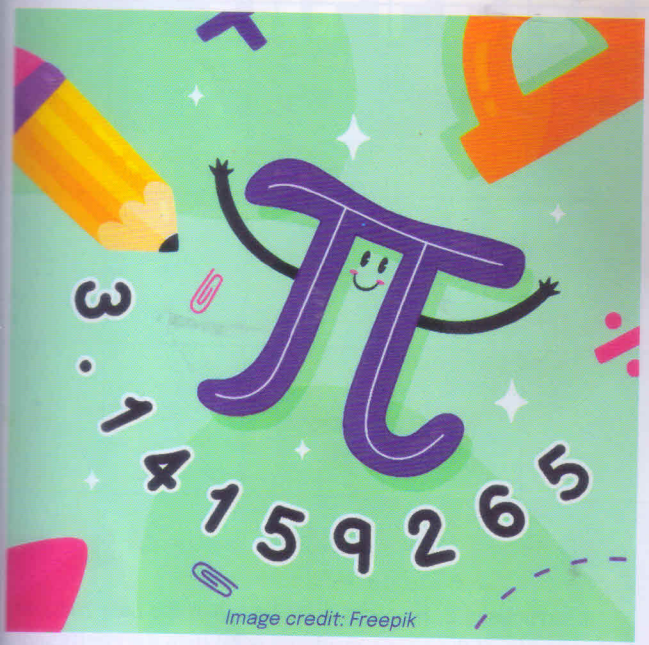

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IF the radius of a circle is given as, say, 100 cm, and you have asked a group of students to find out its area and the length of the circumference, you are likely to have quite a few answers for each of them. The answers may be quite close to each other but are not really the same. The reason lies in the fact that students will have to use the value of pi in both calculations. And the number of places after the decimal in the value of pi plays the deciding role. Someone might have used it as 3.14, and someone else has used it as 3.141, or someone else has taken it as 3.142, considering up to the third place of decimal. You may even find students taking 3.14159 or 3.141592, possibly because they could do these calculations using their hand-held calculators. The more digits taken after the decimal in the value of pi, the more accurate the answer looks.

But in any case, the students feel that the answer remains approximate as they know there are more than 62 trillion digits after the decimal in the value of pi as of now. With more and more high-performing computers, these places after the decimal in the value of pi are increasing, and it will continue. So, we come across the question of how far we should go after decimals while using the pi value. This is a question that has possibly bothered all of us at some point in time, particularly in our student days. We shall take up this question, but before that, let us talk about some other interesting areas associated with this question.

Even some 70-80 years ago, when hand-held calculators were not available, aside from computers at home, in the USA, students were encouraged to memorise quite a few digits after decimals in the value of pi. Today, we may be surprised to know that memorisation of one thousand digits after the decimal was quite an in-thing then. This led to the identification of an interesting place in the value of pi, which became known as the Feynman point. For this discussion, we need to look at the first one thousand digits after the decimal in the value of pi given in Box 1.

Box 1: Pi with first 1000 digits after the decimal

3.1415926535 8979323846 2643383279 5028841971 6939937510 5820974944 5923078164 0628620899
8628034825 3421170679 8214808651 3282306647 0938446095 5058223172 5359408128 4811174502
8410270193 8521105559 6446229489 5493038196 4428810975 6659334461 2847564823 3786783165
2712019091 4564856692 3460348610 4543266482 1339360726 0249141273 7245870066 0631558817
4881520920 9628292540 91715364367892590360 0113305305 4882046652 1384146951 9415116094
3305727036 5759591953 0921861173 8193261179 3105118548 0744623799 6274956735 1885752724
8912279381 8301194912 9833673362 4406566430 8602139494 6395224737 1907021798 6094370277
0539217176 2931767523 8467481846 7669405132 0005681271 4526356082 7785771342 7577896091
7363717872 1468440901 2249534301 4654958537 1050792279 6892589235 4201995611 2129021960
8640344181 5981362977 4771309960 5187072113 4999999837 2978049951 0597317328 1609631859
5024459455 3469083026 4252230825 3344685035 2619311881 7101000313 7838752886 5875332083
8142061717 7669147303 5982 534904 2875546873 1159562863 8823537875 9375195778 1857780532
1712268066 1300192787 66111595909 2164201989