Compilation of Assorted Mathematical Methods

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Abstract:
This short article is a compilation of assorted mathematical methods discovered by the author in high school days. Particularly, methods pertaining to cube roots, fifth roots and an arithmetic progression with varying common difference are outlined.

Keywords: Mathematical Methods, Cube Root, Fifth Root, Progression

1. Introduction
It is not an over-statement to say that nature speaks the language of Mathematics. Ever since man learnt how to count, he has always sought to unravel the mysteries of the universe, and in this adventure, mathematics has always been his best tool and companion. However, the essence of mathematical efficiency lies in simplicity. The simpler the methods and tools are to achieve an objective, the more efficient has been the use of maths in mankind's ventures. Even in the present age of information technology, simple methodologies go a long way in reducing system complexity and thus, power consumption.

This article is a compilation of assorted mathematical methods discovered by the author in the high school days, covering cube roots, fifth roots and an arithmetic progression with varying common difference. In each case, the proposed method is discussed along with suitable illustrations and examples wherever necessary.

2. Finding the Cube Root and Fifth Root of a Number
The objective here is to find a cube root of arbitrarily large numbers without having to resort to Logarithms or Calculus. The proposed steps are as follows, illustrated for an example of 1,879,080,904:

1. Separate the given number into periods of three digits each using commas, beginning from the right. The left extreme period may contain one, two or three digits.
2. Take the first period from the left and find the number which when multiplied by itself twice (cubed) yields a number equal to or less than the period. This number 'a' is the most significant digit (first) of the cube root. Subtract the cube of 'a' from the first period, and bring down the next period. In the example the first period is 1. 1 cubed is 1. So, 'a' is 1, and bring down 879 ('rem').
3. Select the second digit 'b' of the cube root such that the square of that number is less than the first one or two digits of the remainder. In this case 2^2=4<8. Multiply the first 2 digits of the cube root by thirty times 'a', (30axab, in this case 360). Add the square of 'b' to this number to get

360+4=364. Multiply this number by ‘b’, to get 364*2=728, and subtract this number from ‘rem’ (15), bringing down the next period to form the new reminder 151080.

4. Repeat this process till the last reminder is reached (non-zero in case of an imperfect cube). In this case, the reminder is 0 and the cube root is obtained as 1,234.
5. In case of a decimal point, separate the number into periods of 3 from either direction of the decimal point.

The procedure for computing the fifth root of a number is similar to the above outlined cube root procedure, except that the periods are to contain 5 digits rather than 3, and the selection of each ‘a’ and subsequent ‘b’ are decided by the fifth powers, and instead of multiplying with 30, one multiplies with 50. Thus, the fifth root for a number such as 2059,62976 is computed as 46.

3. A Sequence with Progressive increase in Arithmetic Difference

This discovery pertains to a sequence which differs from a regular arithmetic progression in that the common difference ‘d’ increases by 1 for every term. Thus, for a starting term of 1, the sequence is 1,2,4,7,11,16,… for increasing d and 1,0,-2,-5,-9,-14 for decreasing d.

The nth term in this sequence is obtained as 0.5[a+sn(n-1)], with a being the starting term. The Sum upto n terms is given as an+0.5s[n(n+1)(2n+1) – 2n(n+1)]/6. In both relations, ‘s’ is the sign of the varying difference ‘d’.

4. Conclusion

The methods for finding cube roots and fifth roots without the use of logarithms and calculus are described. A new arithmetic progression like sequence, but with progressively varying common difference is outlined.