A STUDY OF THE TRIGONOMETRIC FUNCTIONS IN MATHEMATICS BY USING MATHEMATICAL MODELING

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Abstract:

We have studied the trigonometric formulae's in mathematics by using mathematical modeling techniques. Then we made a 'model' naming as 'Mathematical Watch Model Formula'. This is useful for calculating some results in trigonometry.

Keywords: modeling, mathematical thinking, model, trigonometric etc.

Introduction:

In mathematics, there are some trigonometric function such as sine, cosine, tangent, cotangent, secant and cosecant. We have seen that these functions become its ratio of sides of a triangle; it is as of the following
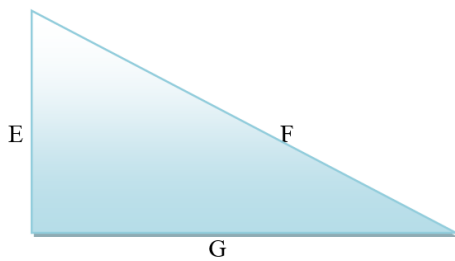
In a right angle triangle, the ratio of sides E and G is sine of angle before side E, the ratio of sides F and G is cosine of angle before side E. The other functions, like tangent is ratio of sine and cosine, cotangent is reciprocal of tangent, secant is reciprocal of cosine and cosecant is reciprocal of sine of angle before side E. These functions are known as trigonometric functions. The value of a lot of various angles of these trigonometric functions can be calculated in a model formula known as 'Mathematical Watch Model Formula'.

I.   Methodology:

Fifth stages form of Mathematical modeling
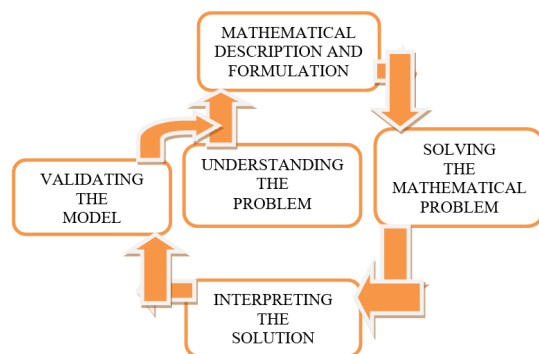
**Figure 1:** The 'operating system' of Mathematical modeling process.

From fig-1, we have observed that 'any problem of real world' can be solved in fifth step. So we say it is fifth stages of mathematical modeling. In the first step understand the real world problem, then second step by using mathematical operations and formulation.

In the third step, for solving mathematical problem by using some assumptions then we get mathematical results. In the fourth step we check the mathematical results with the real world results.

Then in fifth step if the mathematical results are valid with the real world results then this mathematical model is valid otherwise revise the model. This process of mathematical modeling is known as fifth stages of mathematical modeling.

Mathematical Watch Model Formula (MWM-formula):

It is of the following:
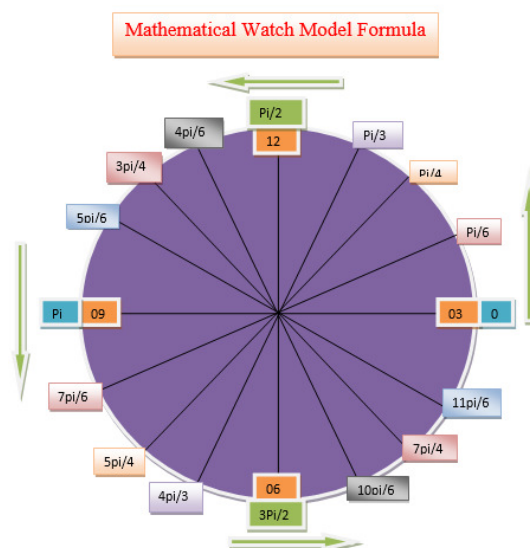
Figure 2: Mathematical Watch Model Formula

We have seen that the students are very difficult to understand the trigonometric functions such as sine, cosine, tangent, cotangent, cosecant, and secant.

Therefore we will try to calculate values of the above trigonometric functions of various angles by using Watch, it is known as Mathematical Watch Model Formula. Such types of formulae are belonging to MWM Formula. There are as of the following, Here 'pi = 180^0' it is used in the following:

1. Sin(2k+1)pi/2) = 1 if k is even
                       = -1 if k is odd
2. Cos(2k+1)pi/2) = 0 for all integer values of k
3. Cot(2k+1)pi/2) = 0 for all integer values of k
4. Cosec(2k+1)pi/2) = 1 if k is even
                         = -1 if k is odd
5. Sec(2k+1)pi/2) = ∞ for all integer values of k
6. Tan(2k+1)pi/2) = ∞ for all integer values of k
7. Sin(3k+1)pi/3) = √3/2 if k is even
                       = -√3/2 if k is odd
8. Cos(3k+1)pi/3) =1/2 if k is even
                       = -1/2 if k is odd
9. Cot(3k+1)pi/3) =1/√3 if k is even
                       = -1/√3 if k is odd
10. Cosec(3k+1)pi/3) = 2/√3 if k is even
                         = -2/√3 if k is odd
11. Sec(3k+1)pi/3) = 2 if k is even
                       = -2 if k is odd
12. Tan(3k+1)pi/3) = √3 if k is even
                       = -√3 if k is odd
13. Sin(6k+1)pi/6) = 1/2 if k is even
                       = -1/2 if k is odd
14. Cos(6k+1)pi/6) = √3/2 if k is even
                       = -√3/2 if k is odd
15. Tan(6k+1)pi/6) =1/√3 if k is even
                       = -1/√3 if k is odd
16. Cosec(6k+1)pi/6) = 2 if k is even
                         = -2 if k is odd
17. Sec(6k+1)pi/6) = 2/√3 if k is even
                       = -2/√3 if k is even
18. Cot(6k+1)pi/6) = √3 if k is even
                       = -√3 if k is odd
19. Sin(4k+1)pi/4) = 1/√2 if k is even
                       = -1/√2 if k is odd
20. Cos(4k+1)pi/4) = 1/√2 if k is even
                       = -1/√2 if k is odd
21. Tan(4k+1)pi/4) =1 if k is even
                       = -1 if k is odd
22. Cosec(4k+1)pi/4) = √2 if k is even
                         = -√2 if k is odd
23. Sec(4k+1)pi/4) = √2 if k is even
                       = -√2 if k is odd
24. Cot(4k+1)pi/4) = 1 if k is even
                       = -1 if k is odd
25. Cos(k)pi) = 1 if k is even
                  = -1 if k is odd
26. Sin(k)pi) = 0 for all integer values of k
27. Tan(k)pi) = 0 for all integer values of k
28. Cosec(k)pi) = ∞ for all integer values of k
29. Sec(k)pi) = 1 if k is even
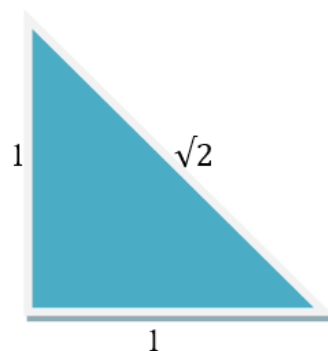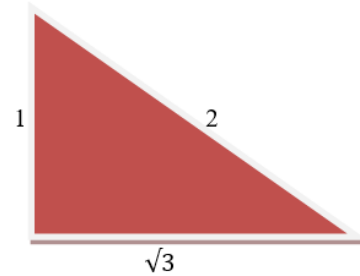
      = -1 if k is odd

30. Cot(k)pi) = ∞ for all integer values of k
31. Sin(6k+4)pi/6) = $\sqrt{3}/2$ if k is even
         = -$\sqrt{3}/2$ if k is odd
32. Cos(6k+4)pi/6) =-1/2 if k is even
         = 1/2 if k is odd
33. Tan(6k+4)pi/6 = -$\sqrt{3}$ for all integer values of k
34. Cosec(6k+4)pi/6 = 2/$\sqrt{3}$ if k is even
         = -2/$\sqrt{3}$ if k is odd
35. Sec(6k+4)pi/6 = -2 if k is even
         = 2 if k is odd
36. Cot(6k+4)pi/6 = -1/$\sqrt{3}$ for all integer values of k
37. Sin(4k+3)pi/4) = 1/$\sqrt{2}$ if k is even
         = -1/$\sqrt{2}$ if k is odd
38. Cos(4k+3)pi/4) = -1/$\sqrt{2}$ if k is even
         = 1/$\sqrt{2}$ if k is odd
39. Tan(4k+3)pi/4 = -1 for all integer values of k
40. Cosec(4k+3)pi/4 = $\sqrt{2}$ if k is even
         = -$\sqrt{2}$ if k is odd
41. Sec(4k+3)pi/4 =- $\sqrt{2}$ if k is even
         = $\sqrt{2}$ if k is odd
42. Cot(4k+3)pi/4 = -1 for all integer values of k
43. Sin(6k+5)pi/6) = 1/2 if k is even
         = -1/2 if k is odd
44. Cos(6k+5)pi/6) =-$\sqrt{3}/2$ if k is even
         = $\sqrt{3}/2$ if k is odd
45. Tan(6k+5)pi/6 = -1/ $\sqrt{3}$ for all integer values of k
46. Cosec(6k+5)pi/6 = 2 if k is even
         = -2 if k is odd
47. Sec(6k+5)pi/6 = -2 /$\sqrt{3}$ if k is even
         = 2/$\sqrt{3}$ if k is odd
48. Cot(6k+5)pi/6 = - $\sqrt{3}$ for all integer values of k

All the 48 trigonometric formulae are included in the mathematical watch model formula.

Therefore we can find the easily values of trigonometric function of any angles in the above MWM formula. So it is very useful to understand and finding the above values.

Conclusion:

We have concluded that the technique of mathematical modeling is useful for solving any problem in mathematics. Here we use this technique to solve easily the results of trigonometric functions such technique is known as mathematical watch model formula (MWM-formula).

References:

1. P. N. Chatterji (1990), Trigonometry, Rajhan's Agencies, Dharama-Alok, Ram Nagar, Meerut (India)
2. S. L. Loney, Plane Trigonometry, published by Book Palace, New Delhi (India)
3. Schoenfeld A. H. (1994), Mathematical Thinking and Problem Solving. Hillsdale: Erlbaum
4. Sayaji Rastum Waykar (2013), Mathematical modeling: A way of a life, IJSER, Vol. 5, Issue 5, May- 2013 edition (USA).
5. Patricia Cam arena Gallardo, N. P. I. Mexico (2009); Mathematical Modeling and Knowledge Transference, Journal of Mathematical Modeling and Application, Vol.1, No.1, 18-36
6. Rui Gomes Neves, Vítor Duarte Teodoro (2010); Enhancing Science and Mathematics Education with Computational Modeling, Journal of Mathematical Modeling and Application, Vol.1, No.2, 2-15
7. Matti Heilio (2009); Mathematics for Society, Industry and Innovation, Journal of Mathematical Modeling and Application, Vol.1, No.1, 77-88