



M.S-11

Mixed Fractions

Addition, subtraction and multiplication

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SYNOPSIS

India has a rich culture heritage, which is preserved in her Sanskrit literature. Her hoary wisdom is contained in it. Addition, subtraction and multiplication of mixed fractions are time consuming, involving number of steps as well as space consuming. This is maiden attempt to make use of Vedic formulae to arrive the sum /product of Mixed fractions and hope everyone will appreciate this paper.

INTRODUCTION

Conventional fixed and general method of multiplication of mixed fractions is time consuming, involving number of steps as well as space consuming. Most of the literature available on mixed fractions deals with those of sum and very little with those of producta. An easy method has been developed to determine the required answers for multiplication of mixed fractions using Vedic formulae.

VEDIC FORMULAE

The resurgence of interest in Vedic Mathematics came about as a result if Jagadguru Shankaracharya of Puri Math Swami Bharati Krshna Tirthji Maharaj (1888-1960) publishing a book on the subject in 1965 which is an alternative system to the present monotonous system for solving mathematics problems. The system is based upon 16 Vedic Formulae in Sanskrit from the appendix of Atharvaveda.

Based on the scientific footings, the problem can solve almost mentally or within few steps. Swamiji has said, "Any mathematics branch – pure or applied – comes in the jurisdiction of these formulae".

The order of steps for mixed fractions in the conventional methods is as follows:

Convert any mixed fractions into improper fraction
Cancel down any numerator with any denominator, in case of multiplication

Multiply

Check that the fraction is in lowest terms

Convert to a mixed fraction if the answer is an improper fraction

To overcome the above step, an attempt has been made in this paper to use three of these formulate to solve the mixed fractions of sum as well as of product separately.

MULTIPLICATION OF MIXED FRACTIONS**Ekadhikena Purvena**

This is the first Vedic sutra meaning "by one more than the previous one". e.g. one more than 16 is 17, and so on. This formula is used for the multiplication of mixed fractions of product. This method is used for multiplication of mixed fractions where the whole number is same and part fractions total equal to one.

Step 1. Right Hand side of the answer is product of part fractions. $\frac{1}{2} * \frac{1}{2} = \frac{1}{4}$

Step 2. The remaining integral digit/s or whole number except half is multiplied by its

ekadhika; and the product so received is written in Left Hand side of the answer. e.g. $3 \frac{1}{2} * 3 \frac{1}{2}$; LHS is product of the number except $\frac{1}{2}$, i.e. 3 and its ekadhika $3+1 = 4$, $3 * 4 = 12$.

$$3 \frac{1}{2} * 3 \frac{1}{2} = 3 * (3 + 1) \text{ and } \frac{1}{2} * \frac{1}{2} = 12 \frac{1}{4}$$

Some more examples

$$9 \frac{1}{2} * 9 \frac{1}{2} = 9 * (9 + 1) \text{ and } \frac{1}{2} * \frac{1}{2} = 90 \frac{1}{4}$$

$$12 \frac{1}{2} * 12 \frac{1}{2} = 12 * 13 \text{ and } \frac{1}{2} * \frac{1}{2} = 156 \frac{1}{4}$$

$$99 \frac{1}{2} * 99 \frac{1}{2} = 9900 \frac{1}{4}$$

If the prefixed whole number or integral part of the given fraction is bigger, the multiplication with its ekadhika can be carried out by any suitable method of multiplication.

Antyayordashakepi

This is another upa-sutra "the also when the sum of last digits is ten". This formulae is used when the two part fractions to be multiplied are such that the sum of their fractions is one



and the remaining integral digit/s or penultimate digit/s are same, the ekadhika sutra can also be applied here for Left Hand Side of the answer, e.g. $3\frac{1}{4} * 3\frac{3}{4}$ are two fractions to be multiplied. Here $\frac{1}{4}$ and $\frac{3}{4}$ part fractions equal to one and the remaining digit is 3 then,

$$3\frac{1}{4} * 3\frac{3}{4} = 3 * 4 \text{ and } \frac{1}{4} * \frac{3}{4} = 12\frac{3}{16}$$

Step 1. Right Hand Side of the answer is product of the part fractions whose sum is one.

Step 2. Left Hand Side of the answer is product of remaining integral digit/s and its Ekadhika

Some more examples

$$9\frac{1}{4} * 9\frac{3}{4} = 9 * 10 \text{ and } \frac{1}{4} * \frac{3}{4} = 90\frac{3}{16}$$

$$19\frac{5}{11} * 19\frac{6}{11} = 19 * 20 \text{ and } \frac{5}{11} * \frac{6}{11} = 380\frac{30}{121}$$

$$99\frac{3}{8} * 99\frac{5}{8} = 99 * 100 \text{ and } \frac{3}{8} * \frac{5}{8} = 9900\frac{15}{64}$$

Anurupyena

This is the first Vedic upa-sutra meaning "proportionately". This Vedic sub formulae is used for multiplication of mixed fractions where the fractional parts sum up to half and the integral parts are the same:

Step 1. Right Hand Side of the answer is product of the part fractions whose sum is half.

Step 2. Left Hand Side of the answer is product of remaining integral whole number and half of the number.

$$4\frac{1}{4} * 4\frac{1}{4} = 18\frac{1}{16} (4 * 4 + \frac{1}{2} \text{ of } 4 \text{ and } \frac{1}{4} * \frac{1}{4})$$

If the left integral or whole number is odd,

$$7\frac{1}{4} * 7\frac{1}{4} = 52\frac{9}{16} (7 * 7 + \frac{1}{2} \text{ of } 7 \text{ and fraction part } 8 + 1 \text{ by } 16)$$

Adyamadyenantyamantyena

This is the another Vedic upa-sutra meaning "the first by the first and the last by the last". This Vedic sub formulae is used for multiplication of mixed fractions where the fractional parts remain same and the integral parts total becomes ten:

Step 1. Right Hand Side of the answer is product of the part fractions.

Step 1. Left Hand Side of the answer is product of remaining integral whole number plus

Product of numerator.

$$3\frac{2}{5} * 7\frac{2}{5} = 25\frac{4}{25} (3 * 7 + 2 * 2 \text{ and } \frac{2}{5} * \frac{2}{5})$$

Addition and subtraction of mixed fractions

The whole integral part of the mixed fractions are to be separated and the part fractions also to be taken separately from LCM, and if the RHS is improper fraction the same will be converted to mixed fraction and added to integral parts total that being the whole digit;

$$3\frac{1}{2} + 2\frac{1}{4} + 5\frac{1}{3} = 11\frac{1}{12} \\ (3+2+5 \text{ and } \frac{1}{2} + \frac{1}{4} + \frac{1}{3}) \\ = 13\frac{1}{12} \text{ or } 11\frac{1}{12}$$

$$5\frac{1}{2} - 2\frac{1}{4} + 3\frac{1}{4} = 6\frac{1}{2} \\ (5 - 2 + 3 \text{ and } \frac{1}{2} - \frac{1}{4} + \frac{1}{4} = \frac{1}{2})$$

A systematic study and research of ancient Veda sutras will enrich the knowledge.

Reference: "Vedic Mathematics" Sri Bharathi Krishna Thiraji