

Astounding Wonders of Ancient Indian Vedic Mathematics

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What are we going to do today?



We shall learn to carry out difficult arithmetic operations such as:

Multiplication:

Multiply **87265** by **32117**.



Reciprocals:

Express **1/19** up to certain number of decimal places.

Division:

Divide **7031985** by **823**.



Find Square roots and Cube roots:

Extract square root of **738915489**.

Find cube root of **9989**.

EACH OF THESE IN MATTER OF SECONDS!!!

Multiplication

Lets start with an easy example:

multiplicand **multiplier**

Multiply 23 by 21

2 3

2 1

4 : 2 + 6 : 3

=483

- Multiply the left-hand-most digit **2** of the **multiplicand** vertically by the left-hand-most digit **2** of the **multiplier**, get their product **4** and set it down as the left-hand-most part of the answer.
- Then multiply **2** and **1**, and **2** and **3** cross-wise, add the two, get **8** as the sum and set it down as the middle part of the answer.
- Multiply **3** and **1** vertically, get **3** as their product and put it down as the last, the right-hand-most, part of the answer.

Activity:

Multiply 16 by 11.



Multiplication

multiplicand **multiplier**

Multiply **37** by **33**

$$\begin{array}{r} 37 \\ \times 33 \\ \hline 901 \\ 32 \\ \hline 1221 \end{array}$$



Activity:

Multiply 35 by 36.

- Multiply the left-hand-most digit **3** of the **multiplicand** vertically by the left-hand-most digit **3** of the **multiplier**, get their product **9** and set it down as the left-hand-most part of the answer.
- Then multiply **3** and **3**, and **7** and **3** cross-wise, add the two to get **30** as the sum.
- The right-hand-most digit is to be put down there and the preceding i.e. left-hand-side digit or digits should be carried over to the left and placed under the previous digit or digits of the upper row.
- Multiply **7** and **3** vertically, get **21** as their product and follow the previous step.
- Add the numbers in the two rows thus obtained to get the required product.

Multiplication

Lets take a step forward:

multiplicand **multiplier**

Multiply **785** by **362**

$$\begin{array}{r} 785 \\ 362 \\ \hline 216760 \\ 6741 \\ \hline 284170 \end{array}$$

Activity

Multiply 621 by 547.

Multiply 795 by 362.



This merely means that we are multiplying

$(ax^2 + bx + c)$ by $(dx^2 + ex + f)$
(where $x = 10$).

Let us try to multiply this!

$$\begin{array}{r} ax^2 + bx + c \\ dx^2 + ex + f \\ \hline \end{array}$$

$$\begin{array}{r} adx^4 + (ae+bd)x^3 \\ + (af + be+cd)x^2 \\ + (bf+ce)x + cf \\ \hline \end{array}$$

Reciprocal

Find the reciprocals of 19, 29 and 49 by division of 1 by 19, 29 and 49.



$$1/19 = 0.052631578947368421$$

$$1/29$$

$$= 0.0344827586206896551724137931$$

$$1/49$$

$$= 0.020408163265306122448979591836734693877551$$

Reciprocal

We shall now find reciprocal of 19 by using a formula from vedic mathematics.

$$1/19 =$$

$$\begin{array}{cccccccc} 0. & 0 & 5 & 2 & 6 & 3 & 1 & 5 & 7 & 8 \\ & 1 & 1 & & & 1 & 1 & 1 & 1 & \\ & 9 & 4 & 7 & 3 & 6 & 8 & 4 & 2 & 1 \\ & 1 & 1 & 1 & & & & & & \end{array}$$

- Put down 1 as the right-hand most digit
- Multiply the last digit 1 by 2 and put the 2 down as the immediately preceding digit.
- Multiply that 2 by 2 and put 4 down as the next previous digit.
- Multiply that 4 by 2 and put 8 down as the next digit.
- Multiply that 8 by 2 and we get 16. Put 6 immediately to the left of the 8 and keep the 1 on hand to be carried forward over to the left at the next step.
- We continue this until we reach the 18th digit counting leftwards from the right.



Activity:

Find $1/29$ and $1/49$.

