

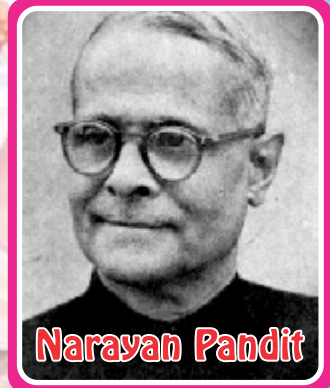


# VEDIC MATHEMATICS

9



D. R. Kaprekar



Narayan Pandit

# Vedic Mathematics

9



$$\begin{array}{r} 4x^2 + 3x + 4 \\ \times 2x^2 + 4x + 5 \\ \hline \end{array}$$

Diagram illustrating the Vedic method for multiplication using arrows. The first diagram shows a central point with four arrows pointing outwards (up, down, left, right) and two diagonal arrows forming an 'X'. The second diagram shows a vertical double-headed arrow pointing up and down, and a diagonal 'X' with arrows pointing outwards. The third diagram shows a vertical double-headed arrow pointing down.

$$8x^4 + 22x^3 + 40x^2 + 31x + 20$$



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### वैधानिक चेतावनी

यह पुस्तक विद्या भारती उत्तर क्षेत्र द्वारा प्रकाशित है। इस पुस्तक का प्रत्येक भाग सर्वाधिकार सुरक्षित है।

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## Preface

Vedic mathematics is an ancient wisdom of fast calculation. It is based on simple rule and principles which enable mathematical problem of all kinds to be solved easily and efficiently. It removes the fear of mathematics and make it enjoyable subject. The Study of Vedic mathematics removes the mathematics phobia and nervousness. It increases self-confidence of learners and no calculator dependency enhances the academic performance. The Vedic method is a boon for all competitive examinations. As a result, the success rate in the examinations becomes higher

Vedic mathematics is based on 16 sutras & 13 sub sutras. It deals with numbers and also with advanced theories such as calculus, simultaneous equations, solving differentiation and integration problems.

The demand of book of 9th standard students since last decades inspires us a lot for writing books on Vedic Mathematics. In this regard the encouragement from Sh. Surender Attri ji. Mantri Vidya Bharti Uttar Kshetra is incomparable. So a meeting was organized at Sanskriti Bhavan Kurukshetra on 4 Nov 2016 and a detail road map has been framed. I sincerely thankful to Sh. Rakesh Bhatia ji, Prant Pramukh Haryana, Sh. Gulshan ji, Sah Prant Pramukh Haryana, Sh. Rakesh Malik ji, Sah Prant Pramukh Delhi, Sh. Devender Singh Yadav ji, Sah Prant Pramukh Delhi, Sh. Mahesh Chand Sharma ji, Prant Pramukh Punjab for their valuable contribution.

As there is always a scope for Improvement, any suggestion from teachers, students and other readers will encourage us to serve the mathematics students.

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## Present Scenario of Vedic Mathematics

Vedic Mathematics is being studied in all over the world. Many renowned personalities have been working in the field of Vedic Mathematics. In the chain of scholars and the lovers of mathematics enquired from Jagatguru Swami Bharti Krishan Tirth ji whether Ganit Sutras are mentioned in Vedas? They also asked Swami ji whether there is mathematics in these sutras. Then Swami ji concentrated on these Ganit Sutras from 1911 to 1918 and answered in positive.

Many institutions have been working in the field of Vedic Mathematics. The journey of Vedic Mathematics in Vidya Bharti started from 1995. In this regard, Vidya Bharti has been training their teachers and students every year to implement Vedic Mathematics in their mathematics syllabus. Besides questioning in exams, many activities like quiz, paper reading, models, practical and Ganit Fares (Melas) are being organized by Vidya Bharti Akhil Bharti Shiksha Sansthan. These activities are being organized at five levels i.e. school level, Sankul level, State level Kshetriya level and National Level.

It is matter of pleasure to know that so many state governments like Madhya Pradesh, Chhattisgarh, Jharkhand and Haryana has initiated to implement Vedic Mathematics in school syllabus. Many universities like kalidas Sanskrit University, Nagpur, Maharaja Agrasen University Baddi (Himachal) and Dr. Hari Singh Gaur Central University Sagar (Madhya Pradesh) have started certificate course and Diploma course in Vedic Mathematics. International Vedic Mathematics Conference has been organized in Kolkata in December, 2016. Many scholars in Mathematics Department have been entitled for the research in the field of Vedic Mathematics by many universities. There is bright future in the field of Vedic Mathematics.

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## Meaning of 16 Sutras of Vedic Mathematics

1. एकाधिकेन पूर्वेण - पहले से एक अधिक के द्वारा।  
By one more than the previous one.
2. निखिलं नवतश्चरतमं दशतः - सभी नौ में से परन्तु अन्तिम दस में से।  
All from nine and last from ten.
3. ऊर्ध्वतिर्यग्भ्याम् - सीधे (खड़े) और तिरछे दोनों प्रकार से।  
Vertically and Crosswise.
4. परावर्त्य योजयेत् - पक्षान्तरण कर उपयोग करें।  
Transpose and apply.
5. शून्यं साम्यसमुच्चये - समुच्चय समान होने पर शून्य होता है।  
When the 'Samuchaya's are the same, that 'Samuchaya' is zero.
6. आनुरूप्ये शून्यमन्यत् - अनुरूपता होने पर दूसरा शून्य होता है।  
If one is in ratio, the other one is zero.
7. संकलनव्यवकलनाभ्याम् - जोड़कर और घटाकर।  
By addition and subtraction.
8. पूरणापूरणाभ्याम् - अपूर्ण को पूर्ण करके।  
By completing.
9. चलनकलानाभ्याम् - चलन-कलन के द्वारा  
By Calculus
10. यावदूनम् - जितना कम है अर्थात् विचलन।  
The Deficiency
11. व्यष्टिसमष्टिः - एक को पूर्ण और पूर्ण को एक मानते हुए।  
Whole as one and one as whole.
12. शेषाण्यङ्केन चरमेण - अंतिम अंक से अवशेष को।  
Remainder by the last digit.
13. सोपान्त्यद्वयमन्त्यम् - अन्तिम और उपान्तिम का दुगुना।  
Ultimate and twice the penultimate.
14. एकन्यूनेन पूर्वेण - पहले से एक कम के द्वारा  
By one less than the Previous one.
15. गुणितमुच्चयः - गुणितों का समुच्चय।  
The whole Product.
16. गुणकसमुच्चयः - गुणकों का समुच्चय।  
Set of Multipliers.

## Meaning of 13 Up-Sutras of Vedic Mathematics










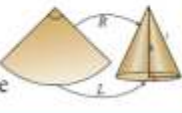
1. आनुरूप्येण - नुरुपता के द्वारा।  
Proportionately.
2. शिष्यते शेषसंज्ञः - बचे हुए को शेष कहते हैं।  
The remainder is the constant
3. आद्यमाद्येनान्त्यमन्त्येन - पहले को पहले से, अंतिम को अंतिम से।  
First by the first and last by the last.
4. केवलैः सप्तकं गुण्यात् - क, व, ल से 7 का गुणा करें।  
Multiply 'ka' (1), 'va' (4), 'la' (3) by 7 (Formula for 1/7).
5. वेष्टनम् - विभाजनीयता परीक्षण की एक विशिष्ट क्रिया का नाम  
The osculation. (A method for divisibility test.)
6. यावदूनं तावदूनम् - जितना कम उतना और कम।  
What ever deficiency further lessen that much.
7. यावदूनं तावदूनीकृत्य वर्ग - जितना कम उतना और कम करके वर्ग की योजना च योजयेत् भी करें।  
Lesser by the deficiency and add its square.
8. अन्त्ययोर्दशकेऽपि - अंतिम अंको का योग दस।  
Sum of last digits is ten.
9. अन्त्ययोरेव - केवल अंतिम द्वारा।  
Only by the last.
10. समुच्चयगुणितः - सर्व गुणन।  
Product of whole.
11. लोपनास्थापनाभ्याम् - विलोपन एवं स्थापना द्वारा।  
By Elimination and retention.
12. विलोकनम् - अवलोकन द्वारा।  
By observing.
13. गुणितसमुच्चयः समुच्चयगुणित- गुणांक के समूहों का गुणनफल और गुणनफल के गुणांको को योग समान होगा।  
Product of the whole is equal to whole of the product.

अन्य विशिष्ट संकल्पनाएँ -

1. द्वन्द्वयोग - द्वयात्मक। (Duplex)
2. शुद्ध - शोधित राशि। (Purity)
3. ध्वजांक - घात के स्थान का अंक। (Flag digit)



## Other Important Formulae of Mathematics

Sl. No	Name	Figure	Lateral or Curved Surface Area (sq.units)	Total Surface Area (sq.units)	Volume (cu.units)
1	Right circular cylinder		$2\pi rh$	$2\pi r(h + r)$	$\pi r^2 h$
2	Right circular hollow cylinder		$2\pi h(R + r)$	$2\pi(R + r)(R - r + h)$	$\pi R^2 h - \pi r^2 h$ $\pi h(R^2 - r^2)$ $\pi h(R + r)(R - r)$
3	Right circular cone		$\pi rl$	$\pi r(l + r)$	$\frac{1}{3}\pi r^2 h$
4	Frustum		$\pi(R+r)\ell$	$\pi(R+r)\ell + \pi R^2 + \pi r^2$	$\frac{1}{3}\pi h(R^2 + r^2 + Rr)$
5	Sphere		$4\pi r^2$	---	$\frac{4}{3}\pi r^3$
6	Hollow sphere		---	---	$\frac{4}{3}\pi(R^3 - r^3)$
7	Hemisphere		$2\pi r^2$	$3\pi r^2$	$\frac{2}{3}\pi r^3$
8	Hollow Hemisphere		$2\pi(R^2 + r^2)$	$2\pi(R^2 + r^2) + \pi(R^2 - r^2)$	$\frac{2}{3}\pi(R^3 - r^3)$
9	Cone		$l = \sqrt{h^2 + r^2}$ $h = \sqrt{l^2 - r^2}$ $r = \sqrt{l^2 - h^2}$	<p>10. Volume of water flows out through a pipe = {Cross section area × Speed × Time }</p> <p>11. No. of new solids obtained by recasting = <math>\frac{\text{Volume of the solid which is melted}}{\text{volume of one solid which is made}}</math></p>	
		<p>CSA of a cone = Area of the sector <math>\pi rl = \frac{\theta}{360} \times \pi r^2</math></p> <p>Length of the sector = Base circumference of the cone</p> 			
12	Conversions	$1 \text{ m}^3 = 1000 \text{ litres}$ , $1 \text{ d.m}^3 = 1 \text{ litre}$ , $1000 \text{ cm}^3 = 1 \text{ litre}$ , $1000 \text{ litres} = 1 \text{ kl}$			

## Other Important Formulae of Mathematics

$$(a+b)^2 = a^2+b^2 +2ab$$

$$(a-b)^2 = a^2+b^2 -2ab$$

$$a^2-b^2=(a+b)(a-b)$$

$$a^2-b^2=(a+b)^2-2ab \quad \text{or} \quad a^2+b^2 = (a-b)^2+2ab$$

$$a^3+b^3=(a+b)(a^2-ab+b^2) = (a+b)^3-3ab(a+b)$$

$$a^3-b^3=(a-b)(a^2+ab+b^2) = (a-b)^3+3ab(a-b)$$

$$2(a^2+b^2)=(a+b)^2+(a-b)^2$$

$$(a+b)^2-(a-b)^2 = 4ab$$

$$a^4+b^4=(a+b)(a-b)[(a+b)^2-2ab]$$

$$(a-b)^2=(a+b)^2-4ab$$

$$(a+b)^2=(a-b)^2+4ab$$

$$a^4+b^4=[(a+b)^2-2ab]^2-2(ab)^2$$

$$(a+b+c)^2=a^2+b^2+c^2+2ab+2bc+2ca$$

$$(a+b-c)^2=a^2+b^2+c^2+2ab-2bc-2ca$$

$$(a-b-c)^2=a^2+b^2+c^2-2ab+2bc-2ca$$

$$a^3+b^3+c^3-3abc=(a+b+c)(a^2+b^2+c^2-ab-bc-ca)$$

$$a^4+a^2b^2+b^4=(a^2+ab+b^2)(a^2-ab+b^2)$$

$$a^4+a^2+1=(a^2+a+1)(a^2-a+1)$$

$$\text{if } a+b+c=0 \text{ then } a^3+b^3+c^3=3abc$$

$$a^8-b^8=(a^4+b^4)(a^2+b^2)(a+b)(a-b)$$

$$a^m \times a^n = a^{m+n}$$

$$(a^m)^n = a^{mn}$$

$$(a^m b^n)^p = a^{mp} b^{np}$$

### Rules of Zero:

$$a^1 = a$$

$$a^0 = 1$$

### Liner Equation:

Linear equation in one variable  $ax+b=0$ ,  $x = -b/a$

Quadratic Equation:  $ax^2+bx+c=0$   $x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$

Discriminant  $D = b^2 - 4ac$

## Other Important Formulae of Mathematics

$$\sin C = \frac{\text{side opposite to angle C}}{\text{hypotenuse}} = \frac{p}{h}$$

$$\cos C = \frac{\text{side adjacent to angle C}}{\text{hypotenuse}} = \frac{b}{h}$$

$$\tan C = \frac{\text{side opposite to angle C}}{\text{side adjacent to angle C}} = \frac{p}{b}$$

$$\operatorname{Cosec}\theta = \frac{1}{\sin\theta} \quad \operatorname{Sec}\theta = \frac{1}{\cos\theta} \quad \cot\theta = \frac{1}{\tan\theta} \quad \tan\theta = \frac{\sin\theta}{\cos\theta}$$

∠A	0°	30°	45°	60°	90°
Sin A	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1
Cos A	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0
Tan A	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	Not defined
Cosec A	Not defined	2	$\sqrt{2}$	$\frac{2}{\sqrt{3}}$	1
Sec A	1	$\frac{2}{\sqrt{3}}$	$\sqrt{2}$	2	Not defined
Cot A	Not defined	$\sqrt{3}$	1	$\frac{1}{\sqrt{3}}$	0

The value of sin or cos never exceeds 1, but the value of sec and cosec is always greater than or equal to 1

$$\sin(90^\circ - \theta) = \cos \theta$$

$$\cos(90^\circ - \theta) = \sin \theta$$

$$\tan(90^\circ - \theta) = \cot \theta$$

$$\cot(90^\circ - \theta) = \tan \theta$$

$$\sec(90^\circ - \theta) = \operatorname{cosec} \theta$$

$$\operatorname{cosec}(90^\circ - \theta) = \sec \theta$$

$$\sin^2\theta + \cos^2\theta = 1$$

$$\sec^2\theta - \tan^2\theta = 1 \text{ for } 0^\circ \leq \theta < 90^\circ$$

$$\operatorname{cosec}^2\theta = 1 + \cot^2\theta \text{ for } 0^\circ \leq \theta \leq 90^\circ$$

$$\text{Probability} = \frac{\text{Number of outcomes favorable to E}}{\text{Total Number of Possible Outcomes}}$$