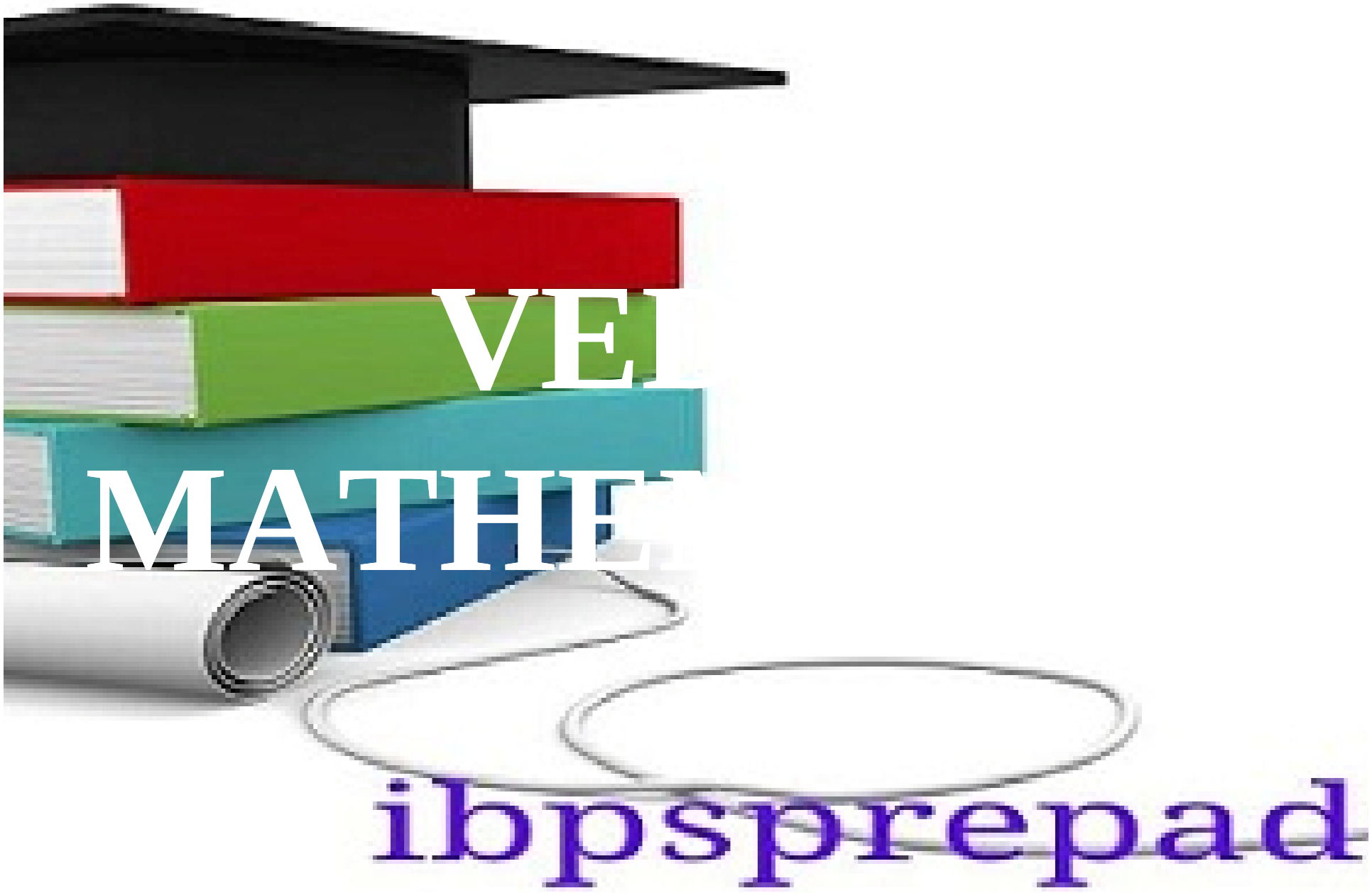
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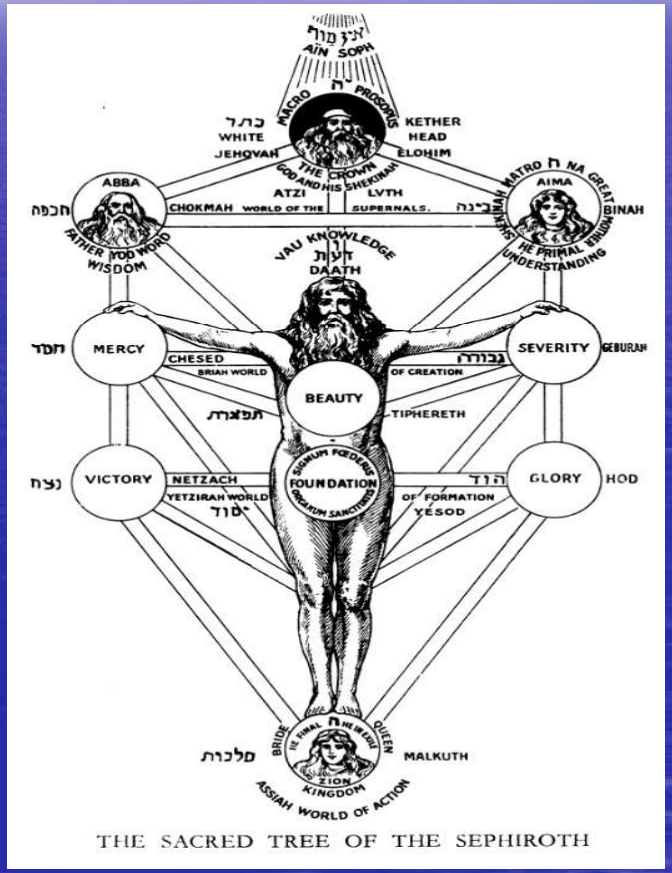
# What is Vedic Mathematics ?

- Vedic mathematics is the name given to the ancient system of mathematics which was rediscovered from the Vedas.
- It's a unique technique of calculations based on simple principles and rules , with which any mathematical problem - be it arithmetic, algebra, geometry or trigonometry can be solved mentally.



THE SACRED TREE OF THE SEPHIROTH

# Why Vedic Mathematics?

- It helps a person to solve problems 10-15 times faster.
- It reduces burden (Need to learn tables up to nine only)
- It provides one line answer.
- It is a magical tool to reduce scratch work and finger counting.
- It increases concentration.
- Time saved can be used to answer more questions.
- Improves concentration.
- Logical thinking process gets enhanced.

# Base of Vedic Mathematics

- Vedic Mathematics now refers to a set of sixteen mathematical formulae or sutras and their corollaries derived from the Vedas.

| Sutra | Translation |
|---|---|
| एकाधिकेन पूर्वेन | By one more than the one before. |
| निखिलं नवतश्चरमं दशतः | All from 9 and the last from 10. |
| ळर्ध्वतिर्यग्भ्यामं | Vertically and Cross-wise |
| परावर्त्य योजयेत् | Transpose and Apply |
| शून्यं साम्यसमुच्चये | If the Samuccaya is the Same it is Zero |
| आनुरूप्ये शून्यं अन्यत् | If One is in Ratio the Other is Zero |
| संकलन व्यवकलनाभ्यां | By Addition and by Subtraction |
| पूरणापूरणाभ्यां | By the Completion or Non-Completion |

# Base of Vedic Mathematics

- Vedic Mathematics now refers to a set of sixteen mathematical formulae or sutras and their corollaries derived from the Vedas.

| | |
|---|---|
| चलनकलनाभ्याम् | Differential Calculus |
| यावदूनं | By the Deficiency |
| व्यष्टिसमष्टिः | Specific and General |
| शेषाण्यङ्केन चरमेण | The Remainders by the Last Digit |
| सोपान्त्यद्वयमन्त्यं | The Ultimate and Twice the Penultimate |
| एकन्यूनेन पूर्वेन | By One Less than the One Before |
| गुणितसमुच्चयः | The Product of the Sum |
| गुणकसमुच्चयः | All the Multipliers |

# EKĀDHIKENA PŪRVEṆA

- *The Sutra (formula) Ekādhikena Pūrvena means:*

*"By one more than the previous one".*

- *This Sutra is used to the*

*'Squaring of numbers ending in 5'.*

# *'Squaring of numbers ending in 5'.*

- Conventional Method

65 X 65

6 5

X 6 5

3 2 5

3 9 0 X

4 2 2 5

- **Vedic Method**

**65 X 65 = 4225**

**( 'multiply the previous digit 6 by one more than itself 7. Than write 25 )**

# NIKHILAM NAVATAS'CHARAMAM DASATAH

- *The Sutra (formula) NIKHILAM NAVATAS'CHARA MAM DASATAH means :*

*"all from 9 and the last from 10"*

- **This formula can be very effectively applied in multiplication of numbers, which are nearer to bases like 10, 100, 1000 i.e., to the powers of 10 (eg: 96 x 98 or 102 x 104).**

# Case I :
# When both the numbers are lower than the base.

- Conventional Method

97 X 94

9 7
X 9 4
3 8 8
8 7 3 X
9 1 1 8

- **Vedic Method**

97 3
X 94 6
9 1 1 8

# Case ( ii) : When both the numbers are higher than the base

- Conventional Method

103 X 105

103

X 105

5 1 5

0 0 0 X

1 0 3 X X

1 0, 8 1 5

- **Vedic Method**

For Example103 X 105

| | | |
|---|---|---|
| | 103 | 3 |
| X | 105 | 5 |
| | 1 0, 8 1 5 | |

# Case III: When one number is more and the other is less than the base.

- Conventional Method

103 X 98

103

X 98

8 2 4

9 2 7 X

1 0, 0 9 4

- **Vedic Method**

| | | |
|---|---|---|
| | 103 | 3 |
| X | 98 | -2 |
| | 1 0, 0 9 4 | |

# ĀNURŨPYENA

- ***The Sutra (formula)*** **ĀNURŨPYENA** ***means :***

  '*proportionality* '

  or

  '*similarly* '

- **This Sutra is highly useful to find products of two numbers when both of them are near the Common bases like 50, 60, 200 etc (multiples of powers of 10).**

# ĀNURŨPYENA

- Conventional Method

46 X 43

4 6

X 4 3

1 3 8

1 8 4 X

1 9 7 8

- **Vedic Method**

46 -4

X 43 -7

1 9 7 8

# ĀNURŨPYENA

- Conventional Method

58 X 48

5 8

X 4 8

4 6 4

2 4 2 X

2 8 8 4

- **Vedic Method**

58 8

X 48 -2

2 8 8 4

# URDHVA TIRYAGBHYAM

- *The Sutra (formula)*

  **URDHVA TIRYAGBHYAM**

  ***means :***

  "Vertically and cross wise"

- **This the general formula applicable to all cases of multiplication and also in the division of a large number by another large number.**

# Two digit multiplication by URDHVA TIRYAGBHYAM

- *The Sutra (formula)*

  **URDHVA TIRYAGBHYAM**

  *means :*

  "Vertically and cross wise"

- **Step 1: 5×2=10, write down 0 and carry 1**
- **Step 2: 7×2 + 5×3 = 14+15=29, add to it previous carry over value 1, so we have 30, now write down 0 and carry 3**
- **Step 3: 7×3=21, add previous carry over value of 3 to get 24, write it down.**
- **So we have 2400 as the answer.**

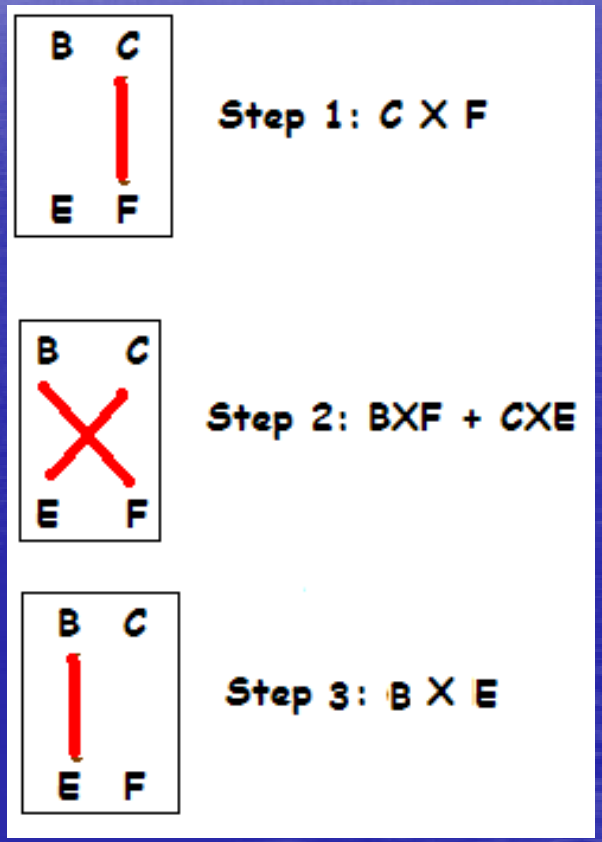
# Two digit multiplication by URDHVA TIRYAGBHYAM

- Vedic Method

4 6

X 4 3

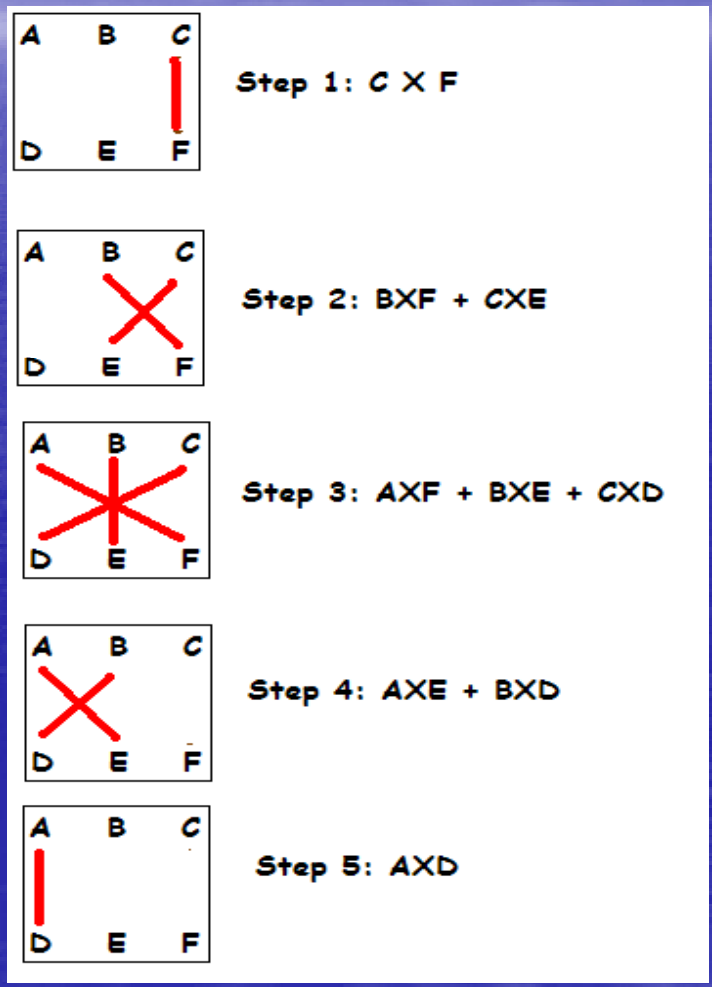
1 9 7 8



# Three digit multiplication by URDHVA TIRYAGBHYAM

- Vedic Method

103
X 105
1 0, 8 1 5



# YAVDUNAM TAAVDUNIKRITYA VARGANCHA YOJAYET

- This sutra means whatever the extent of its deficiency, lessen it still further to that very extent; and also set up the square of that deficiency.
- This sutra is very handy in calculating squares of numbers near(lesser) to powers of 10

# YAVDUNAM TAAVDUNIKRITYA VARGANCHA YOJAYET

$98^2 = 9604$

- The nearest power of 10 to 98 is 100. Therefore, let us take 100 as our base.
- Since 98 is 2 less than 100, we call 2 as the deficiency.
- Decrease the given number further by an amount equal to the deficiency. i.e., perform ( 98 -2 ) = 96. This is the left side of our answer!!.
- On the right hand side put the square of the deficiency, that is square of 2 = 04.
- Append the results from step 4 and 5 to get the result. Hence the answer is 9604.

***Note*** : *While calculating step 5, the number of digits in the squared number (04) should be equal to number of zeroes in the base(100).*

# YAVDUNAM TAAVDUNIKRITYA VARGANCHA YOJAYET

$103^2 = 10609$

- The nearest power of 10 to 103 is 100. Therefore, let us take 100 as our base.
- Since 103 is 3 more than 100 (base), we call 3 as the surplus.
- Increase the given number further by an amount equal to the surplus. i.e., perform ( 103 + 3 ) = 106. This is the left side of our answer!!.
- On the right hand side put the square of the surplus, that is square of 3 = 09.
- Append the results from step 4 and 5 to get the result.Hence the answer is 10609.

***Note*** *: while calculating step 5, the number of digits in the squared number (09) should be equal to number of zeroes in the base(100).*

# YAVDUNAM TAAVDUNIKRITYA VARGANCHA YOJAYET

$1009^2 = 1018081$

# SAŃKALANA – VYAVAKALANĀBHYAM

- *The Sutra (formula)*

  **SAŃKALANA – VYAVAKALANĀBHYAM**

  *means :*

  **'by addition and by subtraction'**

- **It can be applied in solving a special type of simultaneous equations where the x - coefficients and the y - coefficients are found interchanged.**

# SAŃKALANA – VYAVAKALANĀBHYAM

**Example 1:**

**45x – 23y = 113**

**23x – 45y = 91**

- Firstly add them,

( 45x – 23y ) + ( 23x – 45y ) = 113 + 91

68x – 68y = 204

x – y = 3

- Subtract one from other,

( 45x – 23y ) – ( 23x – 45y ) = 113 – 91

22x + 22y = 22

x + y = 1

- Rrepeat the same sutra,

we get **x = 2** and **y = - 1**

# SAŃKALANA – VYAVAKALANĀBHYAM

**Example 2:**

**1955x – 476y = 2482**
**476x – 1955y = - 4913**

- **Just add,**

2431( x – y ) = - 2431

x – y = -1

- **Subtract,**

1479 ( x + y ) = 7395

x + y = 5

- **Once again add,**

2x = 4 x = 2

**subtract**

- 2y = - 6 y = 3

# ANTYAYOR DAŚAKE'PI

- *The Sutra (formula)*

  **ANTYAYOR DAŚAKE'PI**

  *means :*

**‘ Numbers of which the last digits added up give 10.’**

- **This sutra is helpful in multiplying numbers whose last digits add up to 10(or powers of 10). The remaining digits of the numbers should be identical.**

**For Example: In multiplication of numbers**

- **25 and 25,**

  **2 is common and 5 + 5 = 10**
- **47 and 43,**

  **4 is common and 7 + 3 = 10**
- **62 and 68,**
- **116 and 114.**
- **425 and 475**

# ANTYAYOR DAŚAKE'PI

- Vedic Method

$$\begin{array}{r} 67 \\ \times\ 63 \\ \hline 4221 \end{array}$$

- The same rule works when the sum of the last 2, last 3, last 4 - - - digits added respectively equal to 100, 1000, 10000 -- - - .
- The simple point to remember is to multiply each product by 10, 100, 1000, - - as the case may be .
- You can observe that this is more convenient while working with the product of 3 digit numbers

# ANTYAYOR DAŚAKE'PI

892 X 808

= 720736

**Try Yourself :**

**A)** **398 X 302**

**= 120196**

**B)** **795 X 705**

**= 560475**

# LOPANA STHÂPANÂBHYÂM

*The Sutra (formula)*

**LOPANA STHÂPANÂBHYÂM**

*means :*

**'by alternate elimination and retention'**

- **Consider the case of factorization of quadratic equation of type**

$$ax^2 + by^2 + cz^2 + dxy + eyz + fzx$$

- **This is a homogeneous equation of second degree in three variables x, y, z.**

- **The sub-sutra removes the difficulty and makes the factorization simple.**

# LOPANA STHÂPANÂBHYÂM

Example :

$3x^2 + 7xy + 2y^2 + 11xz + 7yz + 6z^2$

- Eliminate z and retain x, y ; factorize
  $3x^2 + 7xy + 2y^2 = (3x + y)(x + 2y)$
- Eliminate y and retain x, z; factorize
  $3x^2 + 11xz + 6z^2 = (3x + 2z)(x + 3z)$
- Fill the gaps, the given expression

  $(3x + y + 2z)(x + 2y + 3z)$

- Eliminate z by putting z = 0 and retain x and y and factorize thus obtained a quadratic in x and y by means of *Adyamadyena* sutra.
- Similarly eliminate y and retain x and z and factorize the quadratic in x and z.
- With these two sets of factors, fill in the gaps caused by the elimination process of z and y respectively. This gives actual factors of the expression.

# GUNÌTA SAMUCCAYAH - SAMUCCAYA GUNÌTAH

Example :

$3x^2 + 7xy + 2y^2 + 11xz + 7yz + 6z^2$

- Eliminate z and retain x, y ; factorize
  $3x^2 + 7xy + 2y^2 = (3x + y)(x + 2y)$
- Eliminate y and retain x, z; factorize
  $3x^2 + 11xz + 6z^2 = (3x + 2z)(x + 3z)$
- Fill the gaps, the given expression

  $(3x + y + 2z)(x + 2y + 3z)$

- **Eliminate z by putting z = 0 and retain x and y and factorize thus obtained a quadratic in x and y by means of *Adyamadyena* sutra.**
- **Similarly eliminate y and retain x and z and factorize the quadratic in x and z.**
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**Prepared By:**

**Ashutosh Kumar**

Mentor (IBPS

Coordina

www.ibpsprepadda.com

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