St.Joseph's College of Education for Women

Opp. Sambasivapet 2nd Lane, Naaz Center, GUNTUR, A.P., INDIA.
(Under the Management of Society of Jesus Mary & Joseph)

LOVE JOY AND SERVICE

3.1.4

Reports of Innovations Tried Out and Ideas Incubated

T. Swarupa Rani
PRINCIPAL
ST. JOSEPH'S COLLEGE OF EDUCATION
FOR WOMEN
GUNTUR-522 001., A.P.

St. Joseph's College of Education for Women
Dt: GUNTUR

Experimental Packages Prepared by our Research Scholars

T. Swaroopa Rani
PRINCIPAL
ST. JOSEPH'S COLLEGE OF EDUCATION
FOR WOMEN
GUNTUR-522 001., A.P

Vedic Mathematics Package

T. Sitarupa Rani
PRINCIPAL
ST. JOSEPH'S COLLEGE OF EDUCATION
FOR WOMEN
GUNTUR-522 001., A.P

Parvartya Yojayet 1

The sutra paravartya yojayet consists of one single word (yojayet) and one compound word (paravartya). The word paravartya is a blending of two words. Para and vartya. Para is used as a prefix to nouns and verbs, and indicates off aside or away. Vartya is derived from the root Vrt and literally means 'to be turned back' or reversed or exchanged. Hence paravartya means "having transposed".

The literal meaning of yojayet is 'you should join' it is a verb form of the word yuj meaning to join, to insert, to unite. In mathematics it can mean add, subtract, multiply etc. hence the sutra is translated in a general way as "transpose and adjust". This is one of the most versatile sutra in the system of vedic mathematics. Its underlying principle of application, when applied to the solution of algebraic equations is gather all the terms involving the single real variable (say x) to the left side of the equations and all the independent terms to the right side of the equation with the condition that every transposition during the process produces a sign inversion i.e

'+' becomes '-' and vice versa

'*' becomes '/' and vice versa

This reduces the number of transposition operation

Type 1

Consider $ax + b = cx + d$

Sol :- Transpose the variables

$$ax - cx = d - b$$

$$x = \frac{d-b}{a-c}$$

Example 1

Solve $7x - 5 = 5x + 1$

Here the equation is in the form of $ax + b = cx + d$

Sol : Vedic method

Here $a = 7 \quad b = -5 \quad c = 5 \quad d = 1$

$$x = \frac{1-(-5)}{7-5}$$

$$= \frac{1+5}{2}$$

$$= \frac{6}{2}$$

$$= 3$$

Conventional method

$$7x - 5 = 5x + 1$$

Getting x terms on one side and constant terms on another side

$$7x - 5x = 5 + 1$$

$$2x = 6$$

$$x = 3$$

Example 2

Solve $5x - 12 = 2x - 6$

Sol :

Here the equation is in the form of

So,

$$x = \frac{d-b}{a-c}$$

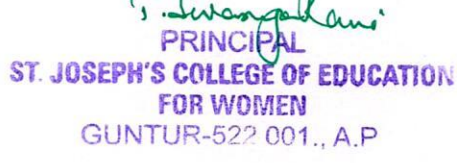
Here

$a = 8, b = 9, c = 7, d = 8$

$$x = \frac{8-9}{8-7}$$

$$x = -\frac{1}{1}$$

$$= -1$$



Example 3

Solve $8m + 9 = 7m + 8$

Sol :- The equation is in the form of

So,

$$m = \frac{d-b}{a-c}$$

Hence $a = 8, b = 9, c = 7, d = 8$

So,

$$m = \frac{8-9}{8-7}$$

$$= -\frac{1}{1}$$

$$= -1$$

TYPE 2

Consider the equation

$$(x + a)(x + b) = (x + c)(x + d)$$

By using vedic sutra paravartya yojayet

$$(x + a)(x + b) = (x + c)(x + d)$$

$$x^2 + bx + ax + ab = x^2 + dx + cx + d$$

$$bx + ax - dx - cx = cd - ab$$

$$x(a + b - c - d) = cd - ab$$

$$x = \frac{cd-ab}{(a+b)-(c+1)}$$

Example 1

Solve $\{(x - 4)(x - 2) = (x + 3)(x + 1)\}$

Sol :- **Conventional method**

$$\{(x - 4)(x - 2) = (x + 3)(x + 1)\}$$

$$x^2 - 2x - 4x + 8 = x^2 + x + 3x + 3$$

$$x^2 - 6x + 8 = x^2 + 4x + 3$$

Cancelling x^2 terms on both sides

$$-6x + 8 = 4x + 3$$

$$x = \frac{1}{2}$$

Example 1

Solve$\{(x-4)(x-2) = (x+3)(x+1)\}$

Sol :-

The equation is in the form of

$$(x+a)(x+b) = (x+c)(x+d)$$

Then by paravartya yojayet

$$x = \frac{cd-ab}{(a+b)-(c+d)}$$

So, $a = -4, b = -2, c = 3, d = 1$

$$x = \frac{3-8}{-6-4}$$

$$= \frac{-5}{-10}$$

$$= \frac{1}{2}$$

Example 2

Solve $(z-7)(z-2) = (z+2)(z-5)$

The equation is in the form of

$$(x+a)(x+b) = (x+c)(x+d)$$

Then by paravartya yojayet

$$z = \frac{cd-ab}{(a+b)-(c+d)}$$

So, $a = -7, b = -2, c = 2, d = -5$

$$z = \frac{2*(-5)-(-7)(-2)}{(-7-2)-(2-5)}$$

$$= \frac{-10-14}{-9-3}$$

$$= -\frac{24}{-12}$$

$$= 2$$

Type 3

Solving equations expressed as ratio to one another

$$\frac{(ax+b)}{(px+q)} = \frac{y}{z}$$

Cross wise multiplication

$$\begin{aligned} (ax+b)\,z &= y(px+q) \\ axz + bz &= ypx + yq \\ azx - ypx &= yq - bz \\ x(ax - yp) &= yp - bz \end{aligned}$$

$$x = \frac{(yq - zb)}{(za - yp)}$$

Example 1

Solve $\frac{(5x+2)}{(2x+3)} = \frac{12}{7}$

Conventional method

Sol :-

Let us multiply both sides of the given equation by (2x+3). This gives

$$\frac{(5x+2)}{(2x+3)}(2x+3) = \frac{12}{7}(2x+3)$$

$$5x + 3 = \frac{12}{7}(2x+3)$$

Again multiply both sides of the equation by 7. This gives

$$\begin{aligned} 7\,(5x+2) &= 7^{*}\,\frac{12}{7}(2x+3) \\ 7\,(5x+2) &= 12\,(2x+3) \\ 35x + 14 &= 24x + 36 \\ 35x + 24x &= 36 - 14 \\ 11x &= 22 \\ x &= 2 \end{aligned}$$

Vedic method

Here

$$a = 5,\ p = 2,\ \ q = 3,\ b = 2,\ y = 12,\ z = 7$$

$$x = \frac{36-14}{(35-24)}$$

$$x = \frac{22}{11}$$

$$x = 2$$

Example 2

Solve the equation

$$\frac{x+7}{3x+16} = \frac{4}{7}$$

Conventional method

By cross multiplication we get

$$7^*(x+7) = 4^*(3y+16)$$
$$7x+41 = 12x+64$$
$$7x-12x = 64-49$$
$$-5x = 15$$
$$x = -3$$

Vedic method

$$x = \frac{(yq-zb)}{(za-yp)}$$

Hence

$$a = 1, b = 7, \ p = 3, q = 10, y = 4, z = 7$$

Substituting the values

$$x = \frac{16-49}{7-12}$$

$$= \frac{15}{-5}$$

$$x = -3$$

TYPE 4

Let the equation be

$$\frac{a}{x+p} + \frac{b}{x+q} = 0$$

$$a(x+a)+b(x+p) = 0$$
$$ax+aq+bx+bp = 0$$
$$(a+b)x = -(aq+bp)$$
$$x = -\left(\frac{aq+bp}{a+b}\right)$$

Example 1

Let the equation is

$$\frac{1}{x-1}+\frac{4}{x+5} = 0$$

Sol :- Conventional method

By LCM we get

$$\frac{1(x+5)+4(x-1)}{(x-1)(x+5)} = 0$$
$$(x+5)+4x-4 = 0$$
$$x+5+4x-4 = 0$$
$$x+4x = 4-5$$
$$5x = -1$$
$$x = -\frac{1}{5}$$

Vedic method

The given equation is in the form of

$$\frac{a}{x-p}+\frac{b}{x+q} = 0$$

Then

$$x = -\left(\frac{aq+bp}{a+b}\right)$$

In this problem

$$a=-1 \quad b=4 \quad p=-2 \quad q=5$$
$$x = -\left(\frac{1*5-4*1}{1+4}\right)$$
$$x = -\frac{1}{5}$$

Example 2

Solve x,

$$\frac{1}{(x-7)}+\frac{1}{(x-9)} = 0$$

Sol :

Conventional method

$$\frac{1}{(x-7)}+\frac{1}{(x-a)} = 0$$

By doing LCM we get

$$\frac{(x-9)+(x-7)}{(x-7)(x-9)} = 0$$

$$(x-9)+(x-7) = 0$$
$$x-9+x-7 = 0$$
$$2x-16 = 0$$
$$2x = 16$$
$$x = 8$$

Vedic method

The given equation us in the form of

$$\frac{a}{x+p}+\frac{b}{x+q} = 0$$

Then

$$x = -\left(\frac{aq+bp}{a+b}\right)$$

Here

$$a = 1, b = 1,\ p = -7, q = -9$$

$$x = -\left(\frac{-7-9}{2}\right)$$

$$x = -\left(-\frac{16}{2}\right)$$

$$x = -8$$

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PRACTICE

Solve for x

I. (1) $7x - 5 = 2x$ (2) $5x - 12 = 2x - 6$

(3) $9y + 5 = 15y - 1$ (4) $3x + 4 = 5(x - 2)$

II. (1) $\frac{5x+3}{2x+4} = \frac{7}{5}$ (2) $\frac{3}{x+1} + \frac{4}{x+2} = 0$

(3) $\frac{8P-5}{7P+1} = -\frac{2}{4}$ (4) $\frac{1}{x+2} + \frac{1}{x+1} = 0$

Urdhavatiryagbhyam 2

Multiplication of two algebraic expressions of two variables

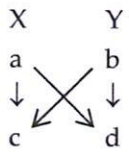
Literally meaning of Urdhavatiryagbhyam is "Vertically and crosswise"

This is a general formula applicable to all cases of multiplication and also be found useful later on division. It is very simplest method in finding the product of algebraic expression with two variables. This can be understood by solving given two polynomials.

Find the product of (ax + by) (cx + dy)

Steps

1. First write the variables
2. Write the coefficients of both the Expressions below them



3. Multiply the numbers by the vertical and cross wise multiplication
4. The product of the vertical terms can be written as x2 terms and y2 terms. The product of the cross wise terms can be written as xy terms
5. Then the product is

$$acx^2 + (ad + bc)xy + b\,dy^2$$

Exercise

Find the product of

$$(5x + 6y) \text{ and } (3x - 2y)$$

Sol :- Conventional method

$(x - 2y)(2x - y)$

$= x(2x - y) - 2y(2x - y)$ (by using distribution law)

$= 2x^2 - xy - 4xy22y^2$

$= 2x^2 - 5xy + 2y^2$ (adding like terms)

TYPE 2

Multiplying a trinomial by a trinomial

Find the product of ax + by + cz and dx + ey + fz

	Instruction/Steps	Procedure
1.	Write the variables	X Y Z
2.	Write the coefficients of both the expressions below them	a b c d e f
3.	Multiply them by vertically and crosswise	ad + (ae + bd)+(bf + ce)+(af + cd) + be + cf
4.	The product of vertical terms can be written terms can be written as x^2, y^2, z^2 terms and crosswise terms can be written xy, yz, xz	$\therefore adx^2 + (ae + bd)xy + (bf + ce)yz + (af + cd)xz + bey^2 + cfz^2$

Exercise 1

Find the product of (3x+ 2y + 4z) and (2x + 5y + 3z)

Sol :- Conventional method

$(3x + 2y + 4z)(2x + 5y + 3z)$

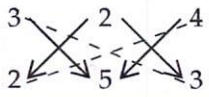
$= 3x(2x+ 5y + 2z) + 2y(2x + 5y + 2z) + 4z(2x + 5y + 2z)$ by using distribution law

$= 6x^2 + 15xy + 9xz + 4xy + 10y^2 + 6yz + 8xz + 20yz + 12z^2$ (adding like terms)

$= 6x^2 + 19xy + 26yz + 17xz + 10y^2 + 12z^2$

Vedic method

$(3x + 2y + 4z)\ (2x + 5y + 3z)$

	Instruction/Steps	Procedure
1.	Write the variables	X Y Z
2.	Write the coefficients of both the expressions below them	
3.	Multiply them by vertically and crosswise	$= 6 + (15 + 4) + (6 + 20) + (8 + 9) + 10 + 12$
4.	Product of vertical terms can be written as x^2, y^2, z^2 terms and crosswise terms can be written as xy, yz, xz	$\therefore 6x^2 + 19xy + 26yz + 17xz + 10y^2 + 12z^2$

Exercise 2

Find the product of $(3x + 4y - 5z)$ and $(2x + 3y)$

Sol :- Conventional method

$(3x + 4y - 5z)(2x + 3y)$

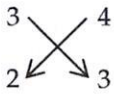
$= 2x(3x + 4y - 5z) + 3y(3x + 4y - 5z)$ using distribution law

$= 6x^2 + 8xy - 10xz + 9xy + 12y^2 - 15yz$

$= 6x^2 + 12y^2 + 17xy - 10xz - 15yz$ (adding like terms)

Vedic method

$(3x + 4y - 5z)(2x + 3y)$

	Instruction/Steps	Procedure
1.	Write the variables	X Y
2.	Write the coefficients of both the expressions below them	
3.	Multiply them by vertically and crosswise	$= 6 + (9 + 8) + (0 + 15) + (0 - 10) + 12 + 0$

$\therefore 6x^2 + 17xy + 15yz - 10xz + 12y^2$

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	Instruction/Steps	Procedure
4.	The product of vertical terms can be written as x^2, y^2, z^2 and crosswise terms can be written as xy, yz, xz terms	$\therefore 6x^2+17xy+15yz-10xz+12y^2$

PRACTICE

(i) (3k + 4l) (3k + 4l)
(ii) (7d – 9e) (7d – 9e)
(iii) (3t + 9s)(6t + 3s)
(iv) (a – 2b + 3c) (a – 5b + 6c)
(v) (x + y)(2x – 5y + 3xy)

Nikilam Navatash Cavamam Dashatah 3

Finding the product of the given numbers N_1,N_2. Through vedic sutra nikilam navatash cavamam dashatah

The literal meaning of this sutra is ALL from 9 and last from 10 i.e subtract last digit from 10 and rest of digits from 9 multiplication using nikhilam sutra used when numbers are closer to power of 10 i.e 10,100,1000 etc. the powers of 10 from which the difference is calculated is called the Base. The difference between given number, and the base is called NIkhilam is always from 9 which is navatash caramam

Find the product of two numbers N1 and N2

(i) Case 1 if N_1, N_2 < base (we have to subtract $(N_1 - D_2)$ or $(N_2 - D_1)$

(ii) Case 2 if N_1, N_2 > base

(iii) Case 3 if N_1 > base
N_2 < base
(or) If N_1 < base
N_2 > base

Steps

(1) Find the difference of the given number N_1 from the base and N_2 from the base

D_1 = base – N_1
D_2 = base – N_2

(2) $N_1 * N_2$ = Number Difference
N_1 D_1
N_2 D_2

(3) Find the product of D_1 and D_2 $= D_1 * D_2 = D$

(4) Find the sum of N_1 and D_2 (or) N_2 and D_1
i.e $E = N_2 + D_1$ (or) $N_1 + D_2$

N_1 D_1
N_2 D_2
N_1+D_2 D_1D_2
(or)
N_2+D_1

(5) Product $N_1*N_2 = (N_1+D_2), D_1*D_2$

(or)

$(N_2+D_1), D_1*D_2$

(6) Write value of N_2+D_1 (or) N_1+D_2 on the left of D_1*D_2 which is ED

CASE (I)

N1,N2 < base

Exercise 1

Find the product of 94*96

Sol :- Regular method

94*96 = using identify formula

$(x-a)(x-b) = x^2-(a+b)(100)+ab$

94*96 = (100–6)(100–4)

Here x = 100, a= 6, b= 4

= (100)2–(6+4)(100)+24

= 10000–10*100+24

= 10000–1000+24

= 9024

Vedic method

Let $N_1 = 94$ $N_2 = 96$

Find the difference of the given number closer to 10 power (base 100)

= 100–94 = –6 (D_1)

= 100–96 = –4 (D_2)

(2) N_1*N_2 =

Number	difference
94	–6
96	–4

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(3) Find the product of D_1*D_2 (94–4) or (6*4) = 24
Find the difference of (N_1–D_2) (96–6)
or (N_2–D_1)

(4) Product of 94*96 = 9024

Exercise 2

Find the product of 88*86

Sol :- Vedic method

Let N_1 = 88 N_2 = 86

Find the difference of the given number closer to 10 power (base 100)

= 100–88 = 12 (D_1)
= 100–86 = 14 (D_2)

N_1*N_2	=	Number	difference
		88	–12
		86	–14

Find the product of D_1*D_2 (88–14) o (12*14) =168
Find the difference of (N_1–D_2) (86–12)
(N_2–D_1)
Product of 88*86 = 74/168
= 7568 (since base is 100, we need to have only 2 digits so carry forward 1)

CASE (II)

If N_1, N_2 > base (we have to add N_1+D_2 or N_2+D_1)

Exercise 1

Find the product of 103*106

Sol :- Vedic method

Let N_1 = 103 N_2 = 106

Find the difference of the given number closer to 10 power (base 100)

		100	+3
		100	+6
N_1*N_2	=	103	3
		106	6

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Find the product of $D_1 * D_2$ = (103+6) or (3*6) = 18
Find the sum of N_1+D_2 or = (106+3)

N_2+D_1

Product of 103*106 = 10918

Exercise 2

Find the product of 104*109

Sol :- Vedic method

Let $N_1 = 104$ $N_2 = 109$

Find the deviation of the given number from the power of 10 (base = 100)

	Number	deviation
	104	+4
	109	+9
Find the product of $D_1 * D_2$ =	4*9 =36	
$N_1 * N_2$	104	3
	109	6
Find the sum of N_1+D_2 or	(104+9) or	36
N_2+D_1	(109+4)	

Product of $N_1 * N_2$ = 11336

Regular method

Using identify formula

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

$104*109 = (100+4)(100+9)$

$= 100^2+(4+9)100+(4*9)$

$= 10000+13*100+36$

$= 10000+1300+36$

$= 11336$

Case (iii)

$N_1 <$ base or $N_1 >$ base

$N_2 >$ base $N_2 <$ base

In this situation one deviation is positive and the other is negative. So the product of deviation become negative. So the right hand side of the answer obtained will therefore have to be subtracted from the base

Exercise 1

Find the product of 104*96

Sol :- Regular method

Using identify

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

Here $a = 100$, $b = 4$

$100*96 = (100+4)(100-4)$

$= 100^2-16$

$= 10000-16$

$= 10084$

Vedic method

Let $N_1 = 104$

$N_2 = 96$

Find the deviation of the given numbers from the power of 10 (base–100)

	Number	deviation
	96	–4
	104	+4
N_1*N_2 (96*104) =	96	–4
	104	+4
Find the product of D_1*D_2 =	(96+4) or	16
Find the sum of (N_1+D_2) or (N_2+D_1)	(104–4)	

Now the right hand side of the answer obtained have to be subtracted from the base $= (100 - 16) = 84$

$\therefore$ $104*96 = 10084$

Exercise 2

Find the product of 93*104

Sol :- Regular method

Using identify

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

$93*100 = (100+(-7))(100+4)$

Where $x = 100, a = -7, b = 4$

$93*100 = (100-7)(100+4)$

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$= 100^2+(-7+4)100+(-7)*4$
$= 10000+(-3)100+(-28)$
$= 10000-300-28$
$= 972$

Vedic method

Let $N_1 = 93$ $N_2 = 104$

Find the deviation of the given number

	Number	deviation
	93	–7
	104	+4
93*104 (N_1*N_2) =	93	–7
	104	+4
Find the product of D_1*D_2	(93+4) or	–28
Find the sum of (N_1+D_2) or (N_2+D_1)	(104–7) = (100–28)	subtract

$\therefore$ 93*104 = 9772

PRACTICE

Find :

(i) 104*98 (ii) 83*77
(iii) 109^2 (iv) 204*206
(v) 109*108 (vi) 196^2

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Anurupena 4

Finding solution of simple quadratic polynomial $ax^2+bx+c=0$ with vedic solution

ANURUPENA

Anurupena is an upa – sutra. Anurupena means proportionality. This sutra is highly useful to find the factors of simple quadratic expressions. In actual application it connects that, in all cases where there is a rational ratio-wise relationship, the ratio should be taken into account and should lead to a proportionate multiplication.

Steps

Let the equation be $ax^2+bx+c=0$

(i) Split the middle coefficient of the polynomial b into numbers p,q such that

$b=p+q$

(ii) Ratio of the first term coefficient (a) to first number (p) of the divided coefficient (b) is same as ratio of second number of to the last term c.

$a:p :: q:c$

$a/p = q/c$ (Let $a/p=r$ $q/c=s$)

(iii) Simplified the ratio of the above is r:s

(iv) The first factor will be $(rx+s)$

(v) Find a/r and c/s, then the second factor will be $((a/r)x+(c/s))$

Solution of $ax^2+bx+c = (rx+s)((a/r)x+(c/s))$

Exercise 1

Factorise the expression $x^2+12x+35$

Sol :- Regular method

$x^2+12x+35 = x^2+(5+7)x+35$

$= x^2+5x+7x+35$ $(\therefore 12x=5x+7x)$

$= x(x+5)+7(x+5)$

(by taking out common factor)

$= (x+7)(x+5)$

Vedic method

- Let the equation be x2+12x+35
- Split the middle coefficient of the polynomial into two numbers

  $12x=7x+5x$
- Ratio of the first term coefficient (a) to the first number (p) of the divided coefficient is same as the ratio of the second number q to the last term c

  $\frac{1}{5} :: \frac{7}{35}$

  $= \frac{1}{5} : \frac{1}{5} = 1:5$
- The first factor will be (x+5)
- Find (a/r) and (c/s) then the second factor will be (x+(35/7))
- Factors are (x+5)(x+7)

Example 2

Factorise $x^2+10x+25$

Sol :- Regular method

$x^2+10x+25 = x^2+(5*5)x+25$

$= x^2+5x+5x+25$

$= x(x+5)+5(x+5)$

$= (x+5)(x+5)$

$= (x+5)^2$

Vedic method

Let the equation be = $x^2+10x+25$

Split the middle term into two numbers a=1, b=10, c=25

$10x=5x+5x$

Let p=5, q=5

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Ratio of the first term coefficient to first number of the divided coefficient is same as the ratio of second term coefficient to second number of the dividend coefficient

$$a:p :: q:c$$
$$a/p :: q/c$$
$$\frac{1}{5} = \frac{5}{25}$$
$$\frac{1}{5} = \frac{1}{5}$$
$$1 = 5$$

The first factor is (rx+s) let r=1 and s=5 so factor is (x+5)
Find a/r and c/s then the second factor will be

$$\left(\frac{a}{r}x + \frac{c}{s}\right)$$
$$\left(\frac{1}{1}x + \frac{25}{5}\right)$$
$$(x + 5)$$

The factors are (x + 5)(x + 5)

Example 3

Factorise $16z^2-48z+36$

Sol :- Vedic method

- Let the equation be $16z^2-48z+36$
  $= 4(4z^2-12z+9)$
  $= 4z^2-12z+9$
- Split the middle term into two number. Here
  a=4, b=12, c=9
  $-12z = -6z-6z$
  Let p =–6, q = –6
- Ratio of the first term coefficient to first number of the divided coefficient is same as the ratio of second number of the dividend coefficient
  $a:p :: q:c$
  $$\frac{a}{p} = \frac{q}{c}$$

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$$\frac{4}{-6}=\frac{-6}{9}$$

$$-\frac{2}{3}=-\frac{2}{3}$$

$r = 2 \qquad s = -3$

- The factor is $(rx+s) = (2x+3)$
- Find the a/r and c/s then the second term will be

$$\left(\frac{a}{r}x+\frac{c}{s}\right)$$

$$\left(\frac{4}{2}x-\frac{9}{3}\right)$$

$$(2x-3)$$

- Factors are $(2x+3)(2x-3)$

PRACTICE

(i) $a^2+10a+25$
(ii) $l^2-4m+64$
(iii) $25x^2+9y^2-30xy$
(iv) $m^2-4m-21$
(v) $x^2-4x-32$

Paravartya Yojayet 5

The sutra paravartya yojayet is use for division of two numbers (or) expression. Especially when a remainder is required. This division is also sometimes referred base-division

PROCEDURE

Step1:- Divide the highest degree the divident with the 1st term of the divisor. Change the sign of divisor '-' to '+' '+' to '-'

Step2 :- Multiply the value (or) result of step 1 by constant (term II) and add to the next term in the expression

Step3 :- Multiply the value or result of step 2 by constant and add to the next term in the expression

Step4 :- Multiply the result of step 3 by constant and

Step5 :- Continue the process until we get the remainder zero or less than constant

Example

Divide $12x^2-8x-32$ by $x-2$

Step 1 :- Divide the highest degree of the divident with the 1st term of the divisor. Change the sign – to + of the divisor

$$\frac{12x^2}{x} = 12x$$

Step 2 :- Multiply the result of step 1 by constant (divisor) (–2) and add to the next term in the expression

$$\begin{array}{r} 12x * 2 = 24\,x \\ -\ 8x - 32 \\ +\ 24x \\ \hline -16 \\ \hline \end{array}$$

Step 3 :- Multiply the value (or) result of step 2 by constant and add to the next term

$16 * 2 = 32$

$$\frac{-32}{+32} = 0$$

$\therefore$ quotient $= 12x + 16$

Remainder $= 0$

Regular method :-

Divide $12x^2-8x-32$ by $x-2$

$x-2)\ 12x^2-8x-32(12x+16$

$-12x^2-24x$

$16x-32$

$-16x-32$

0

$\therefore$ quotient $= 12x+16$

Remainder $= 0$

Example 2

Divide $7x^2+5x+3$ by $x-1$

Step 1 :- Divide the highest degree of the 1st term of the divisor. Change the sign – to +

$$\frac{7x^2}{x}$$

Step 2 :- Multiply the result of step 1 by constant divisor i.e (–1) and add to the next term in the expression

$5x + 13$

$+ 7x$

$+ 12$

Step 3 :- Multiply the result of step 2 by constant i.e +1 and add to the next term in the expression

$5x + 3$

$+ 12$

$+ 15$

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$\therefore$ quotient $= 7x+2$

Remainder $= 15$

Example 3

Divide $6x^2+5x+4$ by $x-1$

Step 1 :- Divide the highest degree of the 1st term of the divisor. Change the sign – to +

$$\frac{6x^2}{x} = 6x$$

Step 2 :- Multiply the result of step 1 by constant divisor i.e (–1) and add to the next term in the expression

$$\begin{array}{r} 5x + 4 \\ +6x \\ \hline +11 \\ \hline \end{array}$$

Step 3 :- Multiply the result of step 2 by constant i.e +1 and add to the next term in the expression

$11 * (+1) = 11$

$$\begin{array}{r} 5x + 4 \\ +11 \\ \hline +15 \\ \hline \end{array}$$

$\therefore$ quotient $= 6x+11$

Remainder $= 15$

PRACTICE

Divide :

(i) $6x^2+10x+8$ by $x+2$

(ii) $x^2+7x+12$ by $x+3$

(iii) $x^2-8x+12$ by $x-6$

(iv) p^2+5p+4 by $p+1$

(v) $a^2-13a+36$ by $a-4$

Sankalana Vyavakalanabhyam 6

The sutra sankalana vyavakalanabhyam means by addition and by subtraction. This sutra is used to solve simultaneous simple equations which have the co-efficients of the variables interchanged

Steps :-

(i) Add the given equations, and reduce by common factors

(ii) Subtract one form other equation and reduce by common factors

(iii) Add and subtract the two new equations again to get the answer

Example 1

Solve $3x+2y = 18$

$2x+3y = 17$

Steps

1. Add both the equation and reduce the equation by common factors

$$\begin{array}{r} 3x+2y = 18 \\ +2x+3y = 17 \\ \hline 5x+5y = 25 \\ 5(x+y) = 25 \\ (x+y) = 5 \end{array}$$

2. Subtract one form other equation and reduce by common factors

$$\begin{array}{r} 3x+2y = 18 \\ 2x+3y = 17 \\ - \\ \hline x-y = 1 \\ \hline \end{array}$$

3. Add and subtract the two new equations again to get the answer

$$\begin{array}{rl} x+y &= 5 \\ x-y &= 1 \\ \hline +2x &= 6 \\ x &= 3 \\ x+y &= 5 \\ x-y &= 1 \\ \hline 2y &= 4 \\ y &= 2 \end{array}$$

$\therefore \quad x = 3, y = 2$

Another method

Let general equation are in the form of

$$ax + by = p$$
$$cx + dy = q$$

Solving these two equations

$$x = \frac{bq - pd}{bc - ad}$$

$$y = \frac{cp - aq}{bc - ad}$$

Example 2

Solve $45x - 23y = 113$
$23x - 45y = 91$

Steps :

1. Add both the equation and reduce the equation by common factors

$$\begin{array}{rl} 45x-23y &= 113 \\ 23x-45y &= 91 \\ \hline 68x - 68y &= 204 \\ 68(x-y) &= 204 \\ (x-y) &= 3 \end{array}$$

2. Subtract one form other equation and reduce by common factors

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$$\begin{aligned} 45x-23y &= 113 \\ 23x-45y &= 91 \\ \hline 22x+22y &= 22 \\ 22\,(x+y) &= 22 \\ (x+y) &= 1 \end{aligned}$$

3. Add and subtract the two new equations again to get the answer

$$\begin{aligned} (x-y) &= 3 \\ (x+y) &= 1 \\ \hline 2x &= 4 \\ x &= 2 \\ (x-y) &= 3 \\ (x+y) &= 1 \\ \hline -2y &= 2 \\ y &= -1 \end{aligned}$$

PRACTICE

(i) $5x-21y = 26$
$21x-5y = 26$

(ii) $659x+956y = 41$
$56x+59y = 38$

Ekadhikena Purvena 7

Ekadhikena purvena is a shortcut method to find square of a number ending with 5. English translation of ekadhikena purvena is by 1 more than the previous (i.e increment the previous digit or digits by 1)

Specific condition required

The last digit of a number should be 5

Procedure

(i) Let the number be ab
(ii) Always b should end with 5
(iii) Multiply a with (a+1) = a(a+1)
(iv) Square the last digit and write on the right side of the product

Example 1

75^2
Multiply 7 with (7+1) = 7(7+1) = 7*8 = 56
Square of the last digit = 25
Answer is $75^2 = 5625$

Example 2

125^2
Multiply 12 with (12+1) = 12(12+1) = 12*13 = 156
Square of the last digit = 25
Answer is $125^2 = 15625$

Finding the square root by vilokanam (observation method)

Procedure

Unit digit of the number	1	4	5	6	9	0
Unit digit of square root	1or9	2or8	5	4or6	3or7	0

(i) Arrange the given number in two digit groups from right to left

(ii) Look at unit digit of the given number and decide about the unit digit of the square root from above table

(iii) Ignore the last two digits (unit's and ten's digits) now see for left side answer

(iv) Find out the greatest number whose square is less than or equal to the remaining part of the given number

(v) Find out the unique number with its unit digit 5 which lies between these two number

(vi) If the given number is less than this square number then smaller number is square root of the given number

Exercise

Find square root of 841

(i) Divide the given number in 2 parts

$\overline{841}$

(ii) '41's unit digit is 1. Therefore unit digit of the square root will be 1 or 9

(iii) Now take left side number i.e 8

(iv) The greatest number whose square is less than or equal to 8 is 2

(v) The two numbers are 21 and 29

(vi) The unique number with unit digit 5 which lies between 21 and 29 is 25

(vii) $25^2 = 625$

Using the ekhadhikena sutra $(25)^2$ $= 2(2+1)25$
$= (2*3)25$
$= 625$

(viii) $841 > 625$

$\therefore$ square root of 841 = 29

Exercise2

Find the square root of 4356

(i) Divide the given number in 2 parts

$\overline{4356}$

(ii) '56's unit digit is 6. Therefore unit digit of the square root will be 4 or 6

(iii) Now take left side number i.e 43

(iv) The greatest number whose square is less than or equal to 43 is $6^2 = 36$ $36<43$

(v) The two numbers are 64 or 66

(vi) Unique number with unit digit 5 is 65

Using ekadhikena sutra

$$65^2 = 6(6+1)25$$
$$= (6*7)25$$
$$= 4225$$

(vii) But the given number is greater than the 4225

$(4356 > 4225)$

$\therefore \quad \sqrt{4325} = 66$

Exercise 3

Find the square root of 8649

- Arrange the given number into two groups 86 49
- Look at the unit digit of the given number and decide about unit digit of the square root from above table 3 or 9
- Find out the greatest number whose square is less than or equal to the 86

  $9^2 = 81$ $(81< 86)$ so 9
- The two numbers are 93 or 99
- Unique number with unit digit 5 is 95
- Using ekhadhikena sutra find

$$95^2 = 9(9+1)25$$
$$= (9*10)25$$
$$= 9025$$

- Compare the given number and unique number square

  $8649 < 9025$

  $\therefore$ The square root of 8649 is 93

Finding Cube Root Using Vedic Sutra

To find out cube root we use vilokanam (observation) method

Table1 :-

Number	1	2	3	4	5	6	7	8	9	10
Cube	1	8	27	64	125	216	343	512	729	1000

Table2 :-

Cube ends in	1	2	3	4	5	6	7	8	9	0
Cube root ends in	1	8	7	4	5	6	3	2	9	0

Steps1 :-

Identify the last three digits and make groups

Step2 :-

Take the last group's last digit and find cube root from table II

Step 3 :-

Take the first group and find the cube which lies between the cubes of the given table I. take smaller number

Step 4 :-

We get the answer

Exercise 1 :-

Find cube root of 13824

Step 1 :-

Identify the given number in two groups 13 824

Step 2 :-

The last group's last digit is 4

So the cube root of last digit is 4

Step 3:-

Take first group number i.e 13 (8<13<27)

From table 1, 13 lies between cubes of 2 and 3

Step 4 :-

Take small digit i.e 2

So the number is 24

∴ Cube root of 13824 is 24

Exercise 2 :-

Find the cube root of 32768

Step 1 :-

Arrange the number into two group's 32 768

Step 2 :-

Take the last group's last digit and find the cube root of last digit 8. Cube root is 2

Step 3 :-

Take first group and observe the number which lies between the table I (27<32<64)

The cube root of first group is 3

∴ The cube root of 32768 is 32

Mind Mathematics Package

St. Joseph's College of Education for Women
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T. Swarupa Rani
PRINCIPAL
ST. JOSEPH'S COLLEGE OF EDUCATION
FOR WOMEN
GUNTUR-522 001., A.P

Efficacy of Mind Mathematics in Arithmetic of Primary School Children – An Experiment

Mind Mathematics: Mathematics is a school subject through which the mental faculty of human being is developed to think logically. Therefor it is a must subject in education system. Mind Mathematics refers to the practice of doing calculations mentally or all in one's head. Mental calculation is performing arithmetical calculations without the aid of tools or supplies. Mind Mathematics is a new and simplified way of doing Arithmetic. Methods or techniques of solving mathematical problems orally without using paper and pen i.e., mental visualization of the solution of the problems. Mind Mathematics is based on procedures which are different from the conventional methods familiar to us.

Experimental Module or Treatment (X_1): Four Modules were prepared by the Investigator to proceed in the experiment as a Treatment (X_1)

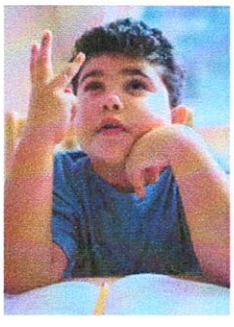
Module 1: Addition – Single & Double digits
Module II: Subtraction – Single & Double digits
Module III: Using Addition & Subtraction – Single & Double digits
Module IV: Combination in Addition
Module V: Combination in Subtraction
Module VI: Combination in Addition & Subtraction

Application of Mind Mathematics Strategy: Arithmetic is the branch of mathematics concerning basic number operations: addition, subtraction, multiplication, and division. As kids, we are taught to do arithmetic because real-world math problems depend on a mastery of elementary arithmetic.

Training oneself to be skilled at Mind Mathematics and the attain the ability to quickly perform simple calculations in mind will strengthen the foundation for learning more advanced maths topics. Being able to add or subtract with your fingers is a valuable skill to have, and people have been doing it since at least the 15th century. It is also helpful for students learning addition and subtraction for the first time.

In U.S. schools, mental calculation is taught only for the most elementary arithmetic, such as single-digit addition and subtraction of two numbers between 0 and 9. To solve addition problems involving multiple digits, you are taught to add columns of digits from right to left, carrying the tens digit if the column sum exceeds 9. For example, how would you approach this addition problem?

TRICKS FOR ADDITION: The basic operation of arithmetic is addition. It combines two or more numbers into one, the sum of the terms. The terms can be added in any order, which is known as the commutative property of arithmetic. On a number line, the sum of two numbers is the total distance from zero covered by both numbers. Basic arithmetic allows us to evaluate the answers to an unlimited number of mathematical expressions. Arithmetical expressions can be purely mathematical, as in 2 + 2, or they can represent quantities in the physical world, such as two items plus two more.



To solve an addition problem mentally, it's best to introduce single digits. This is easier and once the students get familiar, later two are more digits could be introduced. The brain is constantly drawing links between every bit of information that hits our senses – is this what allows us to be aware of what we see with our eyes. The students are trained to use fingers having the hands in front facing up one's palms.

Module for Addition - Instruction: Hold your hands out in front of you with your palms facing up. Each of your five fingers represents a number. Moving from your right thumb: Thumb finger represents 5, Pointing finger 1, Middle finger 1, Ring finger 1 and Small finger 1. At first all the fingers are closed and when any number is added the fingers are opened, when subtracted, the finger is to be hold down / folded / closed.

Example 1: When a number 5 is added to 1 (5+1), the thumb finger and the pointer finger is shown. Repeat the numbers orally and show the finger then the answer is to be expressed. 5+1=6.

Example 2: 1+1+1+5 (Pointing finger + Middle finger + Ring finger + Thumb finger). Answer 9

TRICKS FOR SUBTRACTION: The inverse arithmetical operation of addition is subtraction. It finds the difference between two numbers. Subtraction is not commutative because the order of the numbers determines whether the answer is positive or negative. On a number line, the difference between two numbers is the distance between their positions. The process of subtraction of numbers, the fingers are to be folded / closed, always starting from the little finger.

Module for Subtraction - Instruction: Hold your hands out in front of you with your palms open facing up. Each of your five fingers represents a number. Moving from your right thumb. Thumb finger represents 5, pointing finger 1, middle finger 1, ring finger 1 and small finger 1. At first all the fingers are opened and when any number is subtracted the fingers are closed / folded. Repeat the numbers orally and show the finger then the answer is to be expressed.

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T. Swarupa Rani
PRINCIPAL
ST. JOSEPH'S COLLEGE OF EDUCATION FOR WOMEN
GUNTUR-522 001., A.P.

Example: When a number 1 is subtracted from 9, the little finger is folded and the result is obtained. (9 -1 = 8).

BASIC INSTRUCTION: Hold your right hand out in front of you with your palms facing up. Assume that each of your five fingers represents a number. Moving from your thumb shown in the figure.

Fingers in right hand are used for single digits

Thumb finger represents 5,
pointing finger 1,
middle finger 1,
ring finger 1,
and small / little finger 1.

Right Hand

Rules:

1. At first all the fingers are closed before starting calculation in any arithmetic operations.
2. Initially repeat the numbers orally and show it in the hand fingers while calculating, then express the answers. **"SEE IT SAY IT SHOW IT ANSWER IT".** Synchronize all four for the result.
3. In the process of addition of figures, the fingers are to be opened, always starting from the pointer to little finger. The **fingers in right hand is used for single digits**. The pictorial figures as shown below:

0	1	2	3	4	5	6	7	8	9
									

T. Swarupa Rani
PRINCIPAL
ST. JOSEPH'S COLLEGE OF EDUCATION FOR WOMEN
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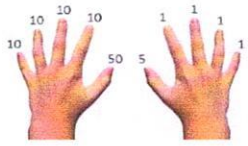
4. In the process of subtraction of numbers of **single digits**, the **fingers of right hand** are to be folded / closed, always starting from the little finger. The pictorial figures as shown:

9	8	7	6	5	4	3	2	1	0
									

Fingers in both hands are used for calculating double digits. The fingers in right hand for 'ones'and fingers in left hand for 'tens' as shown in the figure below.



Left Hand **Right Hand**

5. The **fingers in left hand is used for 'tens' or 'double digits'**. The pictorial figures as shown below:

0	10	20	30	40	50	60	70	80	90
									

6. In the process of subtraction of numbers, the fingers of left hand are to be folded / closed, always starting from the little finger. The pictorial figures as shown:

90	80	70	60	50	40	30	20	10	0
									

<u>Basic Two Arithmatic Operations:</u> Addition and Subtraction

Module 1: Addition – Single to 3 digits

Module II: Subtraction – Single to 3 digits

Module III: Using Addition & Subtraction – Single to 3 digits

Module IV: Combination in Addition

T. Swarupa Rani
PRINCIPAL
ST. JOSEPH'S COLLEGE OF EDUCATION FOR WOMEN
GUNTUR-522 001., A.P.

Module V: Combination in Subtraction
Module VI: Combination in Addition & Subtraction

MODULE - I: ADDITION

Level 1: Using the Fingers in Hands

A. Using the Fingers of Right Hand (Ones / Single digits)
B. Using the Fingers of Left Hand (Tens / Double digits)
C. Using the Fingers of Both Hands (Single & Double digits)

Level 2: Using the Fingers with Closed Eyes

A. Using the Fingers of Right Hand (Ones / Single digits)
B. Using the Fingers of Left Hand (Tens / Double digits)
C. Using the Fingers of Both Hands (Single & Double digits)

Level 3: Using the Fingers with Hands Behind

A. Using the Fingers of Right Hand (Ones / Single digits)
B. Using the Fingers of Left Hand (Tens / Double digits)
C. Using the Fingers of Both Hands (Single & Double digits)

Level 4: Visualization: Learners are trained to visualize or assume the fingers in the space for calculation.

MODULE - I: ADDITION

Level 1: Using the Fingers of Hands

A. Using the Fingers of Right hand: The fingers in right hand is used for **'ones' or 'single digits'**

Thumb finger 5, pointing finger 1,
middle finger 1, ring finger 1, and little finger 1. **Right Hand**

Repeat the numbers orally and show the finger then the answer is to be expressed.

T. Swarajkumari
PRINCIPAL
ST. JOSEPH'S COLLEGE OF EDUCATION
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GUNTUR-522 001., A.P.

Example 1: 1 + 1 =?

Steps	Teacher's Activity	Students Answer	Students Activity
1.	To show ones or single digit, which hand will you use?	We use our Right hand for single digits or ones	
2.	Name the fingers and its numbers	Thumb finger 5, pointing finger 1, middle finger 1, ring finger 1, and little finger 1.	
3.	To add numbers which finger do we begin with for **'ones'**?	Pointer finger to little finger	
4.	To show number 1, which finger is to be opened?	pointer finger	
5.	To show another number 1, which finger will you open along with pointer finger?	middle finger	
6.	What is the answer?	2	

Example 2: 1 + 1 + 5 =?

Steps	Teacher's Activity	Students Answer	Students Activity
1.	To show ones or single number, which hand will you use?	We use our Right hand for single digits or ones	
2.	To show single number 1, which finger is opened?	pointer finger	
3.	To show another single number 1, which finger will you open along with pointer finger?	middle finger	
4.	What is the answer?	2	
5.	To add 5, which finger do we open?	We open thumb finger	
6.	What is the answer?	7	

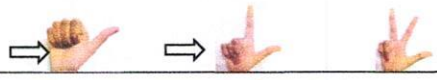
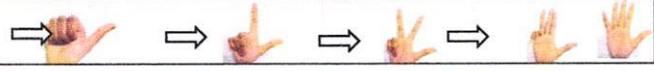
Example 3: 1 + 1 + 1 =?

Steps	Teacher's Activity	Students Answer	Students Activity
1.	To show ones or single number, which hand will you use?	We use our Right hand for single digits or ones	
2.	To show single number 1, which finger is opened?	pointer finger	
3.	To show another single number 1, which finger will you open along with pointer finger?	middle finger	
4.	What is the answer?	2	
5.	To add another single number, which finger do we open?	We open ring finger	
6.	What is the answer?	3	

Exercise 1:

S. No.	Teacher's Activity	Students Activity	Answer
1.	1 + 1+ 1 Answer		3
2.	1 + 1 + 1 + 1 Answer		4
3.	1 + 1 + 1 + 1 + 5 Answer		9

Exercise 2:

S.No.	Teacher's Activity	Students Activity	Answer
1.	5 + 1 Answer		6
2.	5 + 1 + 1 Answer		7
3.	5 + 1 + 1 + 1 Answer		8
4.	5 + 1 + 1 + 1 + 1 Answer		9

Exercise 3:

1 + 5 =?	**1 + 5 = 6**
1 + 5 + 1 = ?	**1 + 5 + 1 = 7**
1 + 5 + 1 + 1= ?	**1 + 5 + 1 + 1 = 8**
1 + 5 + 1 + 1 + 1= ?	**1 + 5 + 1 + 1 + 1= 9**

Exercise 4:

1 + 1 =?	**1 + 1 =2**
1 + 1 + 5 = ?	**1 + 1 + 5 = 7**
1 + 1 + 5 + 1 = ?	**1 + 1 + 5 + 1 = 8**
1 + 1 + 5 + 1 + 1 = ?	**1 + 1 + 5 + 1 + 1 = 9**

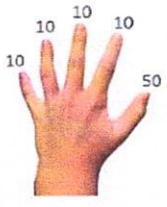
Revision: The **fingers in right hand is used for single digits** as shown below:

0	1	2	3	4	5	6	7	8	9
									

B. Using the Fingers of Left hand: (Tens / Double Digits)

Basic Instructions: Fingers of Left Hand stands for 'Tens' or 'Double Digits'. Hold your left hand out in front of you with your palms facing up. Assume that each of your five fingers represents a number.

Moving from your thumb shown in the figure.



Left Hand

Thumb finger represents 50,
pointing finger 10,
middle finger 10,
ring finger 10,
and small / little finger 10.

T. Swarupa Rani
PRINCIPAL
ST. JOSEPH'S COLLEGE OF EDUCATION FOR WOMEN
GUNTUR-522 001., A.P.

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Repeat the numbers orally and show the finger then the answer is to be expressed.

Example 1: 10 + 10 =?

Steps	Teacher's Activity	Students Answer	Students Activity
1.	To show tens or double digits, which hand will you use?	We use our Left hand for tens or double digit	
2.	Name the fingers and its numbers	Thumb finger 50, pointing finger 10, middle finger 10, ring finger 10, and little finger 10.	
3.	To add numbers which finger do we begin with for tens?	Pointer finger to little finger	
4.	To show double digits – 10, which finger is opened?	pointer finger	
5.	To show another double digits – 10, which finger will you open along with pointer finger?	middle finger	
6.	What is the answer?	20	

Revision: Fingers in Left hand is used for 'tens' or 'double digits' as shown below:

0	10	20	30	40	50	60	70	80	90
									

T. Swarupa Rani
PRINCIPAL
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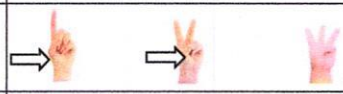
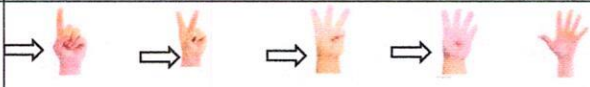
Example 2: 10 + 10 + 20 =?

Steps	Teacher's Activity	Students Answer	Students Activity
1.	To show tens or double digits, which hand will you use?	We use our Left hand for tens or double digit	
2.	To add numbers which finger do we begin with for tens?	Pointer finger to little finger	
3.	To show double digits – 10, which finger is opened?	pointer finger	
4.	To show another 10, which finger will you open along with pointer finger?	middle finger	
5.	To show another 20, which finger will you open along with pointer and middle fingers?		
6.	What is answer for 10 + 10 + 20 =?	40	

Exercise 1:

S.No.	Teacher's Activity	Students Activity	Answer
1.	10 + 10 + 10 Answer		30
2.	10 + 10 + 10 + 10 Answer		40
3.	10 + 10 + 10 + 10 + 50 Answer		90

Exercise 2:

S.No.	Teacher's Activity	Students Activity	Answer
1.	50 + 10 Answer		60
2.	50 + 10 + 10 Answer		70
3.	50 + 10 + 10 + 20 Answer		90

Exercise 3:

10 + 50 = ?

10 + 50 + 10 = ?

10 + 50 + 10 + 10 = ?

10 + 50 + 10 + 10 + 10 = ?

Exercise 4:

10 + 10 = ?

10 + 10 + 50 = ?

10 + 10 + 50 + 10 = ?

10 + 10 + 50 + 10 + 10 = ?

Exercise 5:

50 + 10 = ?

10 + 20 + 50 = ?

40 + 50 = ?

20 + 10 + 50 + 10 = ?

C. Using the Fingers in Both hands: (Single & Double Digits)

Example 1: 10 + 1=?

Steps	Teacher's Activity	Students Answer	Students Activity	
			R. Hand	L. Hand
1.	To show ones or single digit, which hand will you use?	We use our Right hand for tens or double digit		
2.	To show tens or double digits, which hand will you use?	We use our Left hand for tens or double digit		
3.	To add numbers which finger do we begin with for tens?	Pointer finger to little finger		
4.	To show single digit – 1, which finger is opened?	pointer finger		
5.	To show double digits – 10, which finger is opened?	middle finger		
6.	What is the answer for 10 + 1	11		

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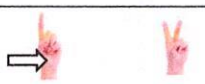
Exercise 1:

S.No.	Teacher's Activity	Students Activity				Students Answer
		Right Hand	Left Hand	R. Hand	L. Hand	
1.	10 + 10 + 1 Answer					**21**
2.	10 + 20 + 3 Answer					33
3.	50+5+3+20 Answer					78

Exercise 1:

10 + 10 + 4 = ?

30 + 5 + 3 + 10 + 1 = ?

10 + 10 + 10 + 3 + 1 + 50 = ?

50 + 10 + 5 + 1 + 2 + 10 + 20 = ?

Exercise 2:

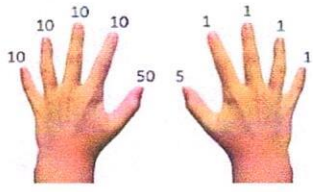
10 + 5 + 4 = ?

20 + 10 + 3 + 10 = ?

10 + 30 + 3 + 1 + 50 = ?

50 + 1 + 2 + 10 + 20 + 5 = ?

Recall: Fingers in both hands are used and the fingers in right hand for single digits and fingers in left hand for double digits. 46, 48, 52,....



Left Hand **Right Hand**

T. Swarupa Rani
PRINCIPAL
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Level 2: Using the Fingers with Closed Eyes

The process done with the fingers of both hands in Level 1 is followed for further exercises given below while the eyes are closed.

Exercise 1:

1 + 2 = ? 2 + 1 + 5 = ?

2 + 2 = ? 1 + 3 + 5 = ?

Level 3: Using the Fingers with Hands Behind

The procedure followed in Level 1 is done with hands behind for the exercise given below.

Exercise:

1 + 2 + 1 + 5 = ? 4 + 5 = ?

2 + 1 + 5 = ?

3 + 5 + 1 = ?

Level 4: Visualization

Learners are trained to visualize or assume the fingers in the space for calculation.

Exercise:

1 + 2 + 1 = ? 3 + 1 = ?

4 + 5 = ? 2 + 1 + 1 + 5 = ?

EXERCISE IN SHEET: **Paper…. (Addition)**

MODULE II: SUBTRACTION

Level 1: Using Fingers of the Hands
Level 2: Using Fingers with Closed Eyes
Level 3: Using Fingers with Hands Behind
Level 4: Visualization

T. Swarupa Rani
PRINCIPAL
ST. JOSEPH'S COLLEGE OF EDUCATION
FOR WOMEN
GUNTUR-522 001., A.P.

St. Joseph's College of Education for Women
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Level 1: Using Fingers of the Hands

A. Using the Fingers in Right hand: The fingers in right hand is used for **'ones' or 'single digits'**

Thumb finger 5,

pointing finger 1,

middle finger 1,

ring finger 1 and

little finger 1.

Repeat the numbers orally and show the finger then the answer is to be expressed.

Example 1: 4 - 1 – 1 = ?

Steps	Teacher's Activity	Students Answer	Students Activity
1.	To show ones or single digit, which hand will you use?	We use our Right hand for single digits or ones	
2.	Name the fingers and its numbers	Thumb finger 5, pointing finger 1, middle finger 1, ring finger 1, and little finger 1.	
3.	To subtract numbers which finger do we close with for ones?	Little finger to pointer finger	
4.	To subtract single digit – 1 from 4, which finger is closed?	Little finger	
5.	To subtract another single digit – 1, which finger will you close along with litle finger?	Ring finger	
6.	What is the answer?	2	

Example 2: 3 - 1 - 1 = ?

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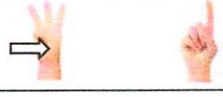
Steps	Teacher's Activity	Students Answer	Students Activity
1.	To show ones or single number, which hand will you use?	We use our Right hand for single digits or ones	
2.	To subtract single number 1 from 3, which finger is closed?	Ring finger	
3.	To subtract another single number 1, which finger will you close along with ring finger?	Middle finger	
4.	What is the answer?	1	

Example 3: 4 - 1 - 2 = ?

Steps	Teacher's Activity	Students Answer	Students Activity
1.	To show 'ones or single number', which hand will you use?	We use our Right hand for single digits or ones	
2.	To subtract single number 1 from 4, which finger is closed?	Little finger	
3.	To subtract another single number 2, which fingers will you close along with little finger?	Ring finger and Middle finger	
4.	What is answer for 4 - 1 - 2 ?	1	

Exercise 1:

S.No.	Teacher's Activity	Students Activity	Answer
1.	3 - 2 Answer		**1**
2.	3 - 1 Answer		**2**

T. Swarajya Rani
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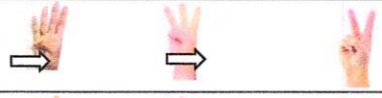
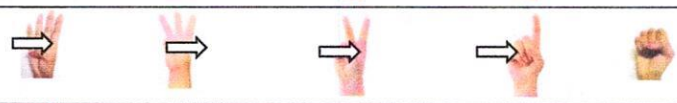
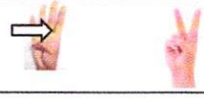
3.	3 - 3 Answer		**0**

Exercise 2:

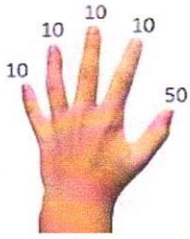
S.No.	Teacher's Activity	Students Activity	Answer
1.	4 – 1 Answer		**3**
2.	4 - 1 - 1 Answer		**2**
3.	4 - 1 - 1 - 1 Answer		**1**
4.	4-1-1-1-1 Answer		**0**
5.	4 - 2 Answer		**2**

Exercise 3:
2 – 2 ?
2 - 1 ?
4 – 3?
4 – 4 ?

Exercise 4:
3 - 2 ?
3 - 1 ?
3 – 1 - 1 ?
3 – 1 – 1 - 1 ?

B. Using Fingers in Left hand: The fingers in left hand is used for **'Tens' or 'Double digits'**

Thumb finger 10,
pointing finger 10,
middle finger 10,
ring finger 10 and
little finger 10.



T. Swarupa Rani
PRINCIPAL
ST. JOSEPH'S COLLEGE OF EDUCATIO..
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Revision: Fingers in Left hand is used for 'tens' or 'double digits' as shown below:

0	10	20	30	40	50	60	70	80	90
									

Example 1: 40 - 10 = ?

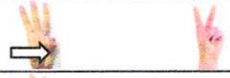
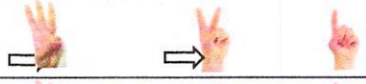
Steps	Teacher's Activity	Students Answer	Students Activity
1.	To show tens or double digit, which hand will you use?	We use our Right hand for tens or double digit	
2.	Name the fingers and its numbers	Thumb finger 50, pointing finger 10, middle finger 10, ring finger 10,and little finger 10.	
3.	To remove numbers which finger do we begin with for tens?	Little finger to Pointer finger	
4.	To subtract double digit – 10 from 40, which finger is closed?	Little finger	
5.	What is the answer?	30	

Example 2: 40 - 10 - 10 =?

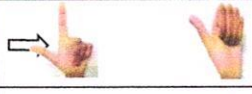
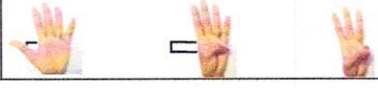
Steps	Teacher's Activity	Students Answer	Students Activity
1.	To show tens or double digit, which hand will you use?	We use our Right hand for tens or double digit	
2.	To subtract numbers which finger do we begin with for tens?	Little finger to Pointer finger	

3.	To subtract double digit – 10 from 40, which finger is closed?	Little finger	
4.	To subtract another 10, which finger will you open along with little finger?	Ring finger	
5.	What is the answer for?	20	

Exercise 1:

S.No.	Teacher's Activity	Students Activity	Answer
1.	30 - 10 ?		20
2.	30 - 10 - 10 ?		10
3.	30 – 10 – 10 - 10 ?		0

Exercise 2:

S.No.	Teacher's Activity	Students Activity	Answer
1.	60 - 10 ?		50
2.	90 - 20 ?		70
3.	90 – 50 – 10 ?		30

Exercise 3:

40 – 10 = ?	40 – 10 = 30
60 – 10 = ?	30 – 10 = 50
70 – 50 = ?	70 – 50 = 20
10 – 10 = ?	10 – 10 = 0

Exercise 4:

30 – 10 – 10 = ?	30 – 10 – 10 = 10
50 – 20 – 10 = ?	50 – 20 – 10 = 20
80 – 50 – 10 = ?	80 – 50 – 10 = 20
90 – 10 – 20 – 50 = ?	90 – 10 – 20 – 50 = 10

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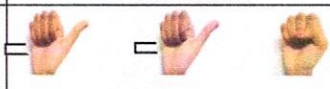
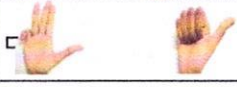
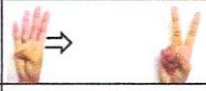
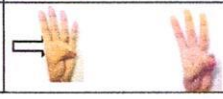
C. Using Fingers of Both Hands (Single & Double digits)

Exercise 1:

S.No.	Teacher's Activity	Students Activity		Answer
		Right hand	Left hand	
1.	75 - 10 - 5 ?			60
2.	87 – 20 - 5 ? ⇨			62
3.	48 – 10 - 3 ?			35

Exercise 2:

S.No.	Teacher's Activity	Students Activity		Answer
		Right hand	Left hand	
1.	34 – 10 - 2 ?			22
2.	88 – 20 - 5 ? ⇨			63
3.	48 – 10 - 3 ?			35

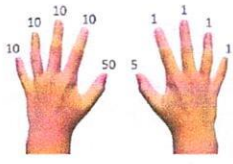
Exercise 3:

55 – 5 = ?	50
19 – 4 = ?	15
28 – 3 = ?	25
62 – 12 = ?	50

Exercise 4:

64 – 10 – 2 ?	42
39 – 20 – 5 - 1 ?	13
88 – 10 – 3 – 10 – 5 ?	60
72 – 50 – 1 ?	21

Recall: Fingers in both hands are used and the fingers in right hand for single digits and fingers in left hand for double digits.



Level 2: Using Fingers with Closed Eyes
The process done with the fingers of both   hands in Level 1 is followed for further exercises given below while the eyes are closed.

Exercise 1:

26 - 5 ?	21
39 – 10 - 3 ?	26
55 – 10 – 10 - 5 ?	50
78 – 10 – 3 - 10 ?	55
97 – 50 – 2 - 5 ?	40

<<,

Level 3: Using Fingerswith Hands Behind
The procedure followed in Level 1 is done with hands behind for the exercise given below.

Exercise:

11 – 1 = ?	10
14 – 2 = ?	12
24 – 13 = ?	11
33 – 10 = ?	23
65 – 05 = ?	60

Level 4: Visualization: Learners are trained to visualize or assume the fingers in the space for calculation.

Exercise:

66 - 2 = ?	65
87 – 10 – 5 = ?	72
78 – 10 – 3 - 20 ?	65
89 – 5 – 10 – 2 - 10 ?	57
99 – 20 – 1 – 50 – 2 - 10 ?	21

EXERCISE IN SHEET: **Paper…. (Subtraction)**

MODULE III: ADDITION & SUBTRACTION

Level 1: Using Fingers in the Hands
Level 2: Using Fingers with Closed Eyes
Level 3: Using Fingers with Hands Behind
Level 4: Visualization

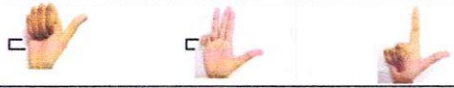
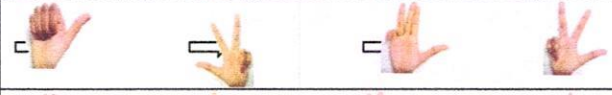
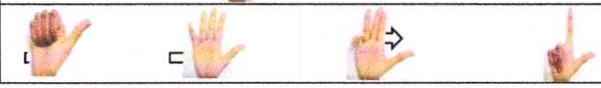
Level 1: Using Fingers of the Hands

A. Using Fingers of Right Hand (Ones / Single digits)

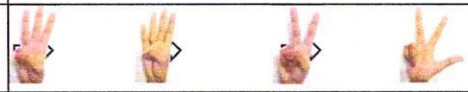
Revision: The **fingers in right hand is used for single digits** as shown below:

0	1	2	3	4	5	6	7	8	9
									

Exercise 1:

S. No.	Teacher's Activity	Students Activity	Answer
1.	5 + 3 - 2 ?		6
2.	5 + 2 + 1 – 1 ?		7
3.	5 + 4 – 1 - 2 ?		6

Exercise 2:

S. No.	Teacher's Activity	Students Activity	Answer
1.	3 + 1 – 2 + 5 ?		7
2.	2 + 1 + 1 + 5 - 4 ?		5
3.	4 – 2 + 5 - 1 ?		6

Exercise 3:

2 + 1 + 1 – 2 = ?	2
3 + 1 – 2 = ?	2
2 + 1 – 1 = ?	2
1 + 1 + 2 – 1 – 1 = ?	2
2 + 5 – 2 + 3 – 1 = ?	7

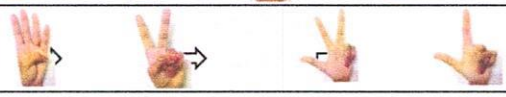
Exercise 4:

4 – 2 + 1 + 1 – 1 = ?	3
4 + 1 – 3 + 1 + 1 – 1 = ?	3
3 – 2 + 3 – 1 = ?	3
2 + 1 + 1 – 2 + 1 = ?	3

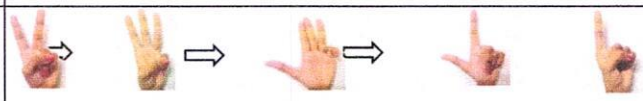
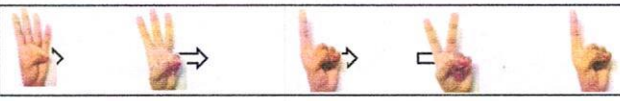
B. Using Fingers of Left Hand (Tens / Double digits)

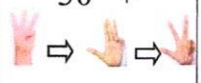
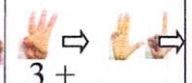
0	10	20	30	40	50	60	70	80	90
									

Exercise 1:

S. No.	Teacher's Activity	Students Activity	Answer
1.	30 + 10 – 30 ?		10
2.	20 + 10 - 10 + 50 - 20 ?		50
3.	40 – 20 + 50 - 10 ?		60

Exercise 2:

S. No.	Teacher's Activity	Students Activity	Answer
1.	20 + 10 + 50 - 20 ⇨ 50 ?		10
2.	10 + 10 + 50 – 20 + 30 ?		80
3.	40 – 10 – 20 + 10 - 10 ?		10

2.	10+20+20+3+4 = ?	10 + 20 +50  - 30	3 + 5 - 1 			57
3.	30 + 3 + 3 + 40 = ?	30 +  50 - 10	 3 + 5 - 2			76

Exercise 1:

10 + 10 + 40 = ? 10 + 10 + 50 – 10 = 60

30 + 4 + 2 + 20 + 1 = ? 30 + 4 + 5 – 3 + 50 – 30 + 1 = 57

40 + 10 + 10 + 3 + 2 + 20 = ? 40 + 50 – 40 + 10 + 3 + 5 - 3 + 20 = 85

40 + 20 + 1 + 4 + 10 + 20 + 2 = ? 40 + 50 – 30 + 1 + 5 - 1 + 20 + 2 = 93

22 + 12 + 3 + 1 = ? 22 + 12 + 5 - 2 + 1 = 38

Level 2: Using the Fingers With Closed Eyes

A. Using the Fingers of Right Hand (Ones / Single digits)

A. Using the Fingers of Left Hand (Tens / Double digits)

B. Using the Fingers of Both Hands (Single & Double digits)

Level 3: Using the Fingers With Hands Behind

A. Using the Fingers of Right Hand (Ones / Single digits)

B. Using the Fingers of Left Hand (Tens / Double digits)

C. Using theFingers of Both Hands (Single & Double digits)

Level 4: Visualization

MODULE V: COMBINATION IN SUBTRACTION

Level 1: Using Fingers of the Hands

C. Using the Fingers of Right Hand (Ones / Single digits)

B. Using the Fingers of Left Hand (Tens / Double digits)

C. Using the Fingers of Both Hands (Single & Double digits)

Level 2: Using Fingers With Closed Eyes

A. Using the Fingers of Right Hand (Ones / Single digits)

B. Using the Fingers of Left Hand (Tens / Double digits)

C. Using the Fingers of Both Hands (Single & Double digits)

Level 3: Using Fingers With Hands Behind

A. Using the Fingers of Right Hand (Ones / Single digits)
B. Using the Fingers of Left Hand (Tens / Double digits)
C. Using theFingers of Both Hands (Single & Double digits)

Level 4: Visualization

MODULE V: COMBINATION IN SUBTRACTION

Level 1: Using the Fingers in the Hands

To help the children to practice the following combinations in subtraction

A. Subtraction – Using the Fingers of Right Hand (Ones / Single digits):
To help the children to practice the following combinations in subtraction for single digits with Right hand fingers.

Example 1: 5 - 2 = ?

S.No.	Teacher's Activity	Students Activity	
1.	Which hand is used for number 5?	Right hand	
2.	Which finger is used for number 5?	Thumb finger	
3.	Let's take 5 first	Yes	
4.	To remove 2, what do we do?	First we close the thumb finger representing 5	
5.	We are supposed to close only 2 but we closed 5. The extra figures closed is to be opened. How many fingers are to be opened?	3 fingers are to be opened	
6.	What is the answer now?	3	
7.	What is process done in the hands?	5 – 5 + 3	

B. Subtraction – Using the Fingers in Left Hand (Tens / Double digits):
To help the children to practice the following combinations in subtraction in double digits.

Example 1: As we have assumed in single digits, the same could be assumed for double digits too with Left hand fingers.

S. No.	Teacher's Activity	Student's Answer	Students Activity
1.	What number the thumb finger in Left hand assumed for?	50	
2.	Teacher writes on the Black Board all the possible equations to help the students to understand easily and asks them to repeat.	50 = 40 + 10 50 = 30 + 20 50 = 20 + 30 50 = 10 + 40	

Example 2: 40 + 20 = ?

S. No.	Teacher's Activity	Students Activity
1.	Which hand is used for number 40?	Left hand
2.	Let's take 40 first	Yes 
3.	To add 20, do we have fingers?	No
4.	Which finger do we have in the hand?	Thumb finger
5.	What does thumb finger assumed for?	50
6.	How many tens are there in 5?	50 tens are there.
7.	Teacher writes on the black Board: 50 = 10 + 10 + 10 +10 + 10	50 is equal to 10 +10 + 10 +10 +10 
8.	What do we need to add with 40?	We need to add only 20
9.	Can we take 50 = (10+10) + (10+10+10)?	Yes, 50 = 20+30 = (10 + 10)+(10 + 10 + 10)
10.	To add 40 with 20, what shall we do?	We can open the thumb finger 50 and close 30 other fingers
11.	Take 40 and open 50 and remove 30	40 + 50 
12.	Take only 20 from 50, how many to be removed?	30 to be removed. 40 + 50 - 30 
13.	What is the answer now?	60 

Exercise 3:

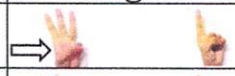
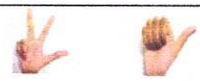
40 – 20 + 10 + 10 – 30 ? 10
50 + 30 – 10 – 50 ? 20
60 + 20 – 10 + 20 – 30 ? 60
70 – 10 + 30 – 50 – 10 ? 30
10 + 10 + 50 – 20 + 30 ? 80

Exercise 4:

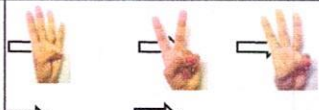
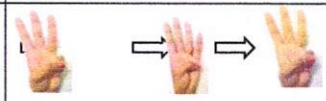
20 + 10 + 50 – 20 + 30 -50 ? 40
30 – 10 + 20 + 50 – 30 ? 60
40 – 20 + 50 + 10 – 50 ? 30
50 + 20 – 10 + 30 – 20 ? 70

C. Using Fingers of Both Hands (Single & Double digits)

Exercise 1:

S. No.	Teacher's Activity	Students Activity		Answer
		Right hand	Left hand	
1.	30 + 5 - 20 ?			15
2.	40 + 8 - 10 ?			38
3.	20 + 20 + 7 – 10 - 2 ?			35

Exercise 2:

S. No.	Teacher's Activity	Students Activity		Answer
		Right hand	Left hand	
1.	45 – 5 – 20 + 10 ?			30
2.	77 + 10 – 20 – 5 ?			62
3.	30 + 10 + 7 – 10 - 2 ?			35

Exercise 3:

25+ 3 +10 – 30 = ? 8

33 + 1 + 10 – 3 – 20 = ? 21
44 – 4 + 2 – 20 + 2 = ? 20
52 + 2 + 30 – 1 – 10 – 20 = ? 53

Exercise 4:

55 + 3 + 10 – 2 + 20 ? 86
75 + 3 + 10 – 5 – 2 ? 81
88 – 2 + 10 – 50 + 2 – 10 ? 38
69 – 2 – 50 + 20 – 5 ? 32

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Level2: Using Fingers With Closed Eyes

A. Fingers of Right Hand (Ones / Single digits)

Exercise:

B. Fingers of Left Hand (Tens / Double digits)

Exercise:

C. Fingers of Both Hands (Single &Double digits)

Exercise:

Level 3: Using Fingers With Hands Behind

A. **Fingers of Right Hand (Ones / Single digits)**

Exercise:

B. **Fingers of Left Hand (Tens)**

Exercise:

C. **Fingers of Both Hands (Double digits)**

Exercise:

Level 4: Visualization

Exercise:

EXERCISE IN SHEET: **Paper….** **(Addition & Subtraction)**

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MODULE IV: COMBINATION IN ADDITION

Level 1: Using Fingers of the Hands

A. Using the Fingers of Right Hand (Ones / Single digits) : To help the children to practice the following combinations in addition for single digits with Right hand fingers.

S. No.	Teacher's Activity	Student's Answer	Students Activity
1.	What number the thumb finger in Right hand assumed for?	5	
2.	How many 'ones' are there in 5?	5 ones are there	5 = 1 + 1+1+1+1
3.	How many 'twos' are there?	2 twos are there	5 = 2 + 2 + 1 = 4 + 1
4.	How many 'threes' are there?	1 three is there	5 = 3 + 2
5.	Teacher writes on the Black Board all the possible equations to help the students to understand easily and asks them to repeat.	5 = 4 + 1 5 = 3 + 2 5 = 2 + 3 5 = 1 + 4	

Exercise 1: 4 + 2 = ?

S. No.	Teacher's Activity	Students Activity	
1.	Which hand is used for number 4?	Right hand	
2.	What is the problem?	4 + 2 = ?	
3.	What shall we do first?	We take 4 in the right hand	
4.	To add 2, do we have fingers?	No	
5.	Which finger do we have in the hand?	Thumb finger	
6.	What does thumb finger assumed for?	5	
7.	How many ones are there in 5?	5 ones are there.	
8.	What are the ways we can do with 5?	5 = 4 + 1 5 = 3 + 2 5 = 2 + 3	

		5 = 1 + 4	
9.	What do we need to add with 4?	We need to add only 2	
10.	What shall we do to add 4 with 2?	We can take 5 = 2 + 3	5 = 2 + 3
11.	To add 4 with 2, what shall we do?	We can open the thumb finger 5 and close 3 other fingers	
12.	Take 4 and open 5 and remove 3	4 + 5	4+ 5 
13.	Take only 2 from 5, how many to be removed?	3 to be removed.	4+ 5 - 3 
14.	What is the answer now?	6	

Rule: ***In the process of addition of single digits in right hand, when all the fingers representing 1, are already opened and you need more fingers to represent 1, the thumb finger could be opened representing 5, after taking needed figures remove the extra figures by closing the fingers representing 1.***

More exercises are given to understand the concept of combination in Addition until the students could respond correctly.

B. Addition – Using the Fingers of Left Hand (Tens / Double digits): To help the children to practice the following combinations in addition in double digits.

Example 1: As we have assumed in single digits, the same could be assumed for double digits too with Left hand fingers

S. No.	Teacher's Activity	Student's Answer	Students Activity
1.	What number the thumb finger in Left hand assumed for?	50	
2.	Teacher writes on the Black Board all the possible equations to help the students to understand easily and asks them to repeat.	50 = 40 + 10 50 = 30 + 20 50 = 20 + 30 50 = 10 + 40	

Example 2: 40 + 20 = ?

S. No.	Teacher's Activity	Students Activity
1.	Which hand is used for number 40?	Left hand
2.	Let's take 40 first	Yes
3.	To add 20, do we have fingers?	No
4.	Which finger do we have in the hand?	Thumb finger
5.	What does thumb finger assumed for?	50
6.	How many tens are there in 5?	50 tens are there.
7.	Teacher writes on the black Board: 50 = 10 + 10 + 10 +10 + 10	50 is equal to 10 +10 + 10 +10 +10
8.	What do we need to add with 40?	We need to add only 20
9.	Can we take 50 = (10+10) + (10+10+10)?	Yes, 50 = 20+30 = (10 + 10)+(10 + 10 + 10)
10.	To add 40 with 20, what shall we do?	We can open the thumb finger 50 and close 30 other fingers
11.	Take 40 and open 50 and remove 30	40 + 50
12.	Take only 20 from 50, how many to be removed?	30 to be removed. 40 + 50 - 30
13.	What is the answer now?	60

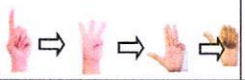
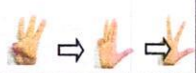
C. Addition – Using the Fingers of Both Hands (Single & Double digits):

Example 1:

S.No.	Teacher's Activity	Students Activity				Students Answer
		Right Hand	Left Hand	R. Hand	L. Hand	
1.	10 + 4 + 2 = ?	10	4+ 5 - 3			16

C. Subtraction – Using the Fingers in Both Hands (Single & Double digits):

Example 1:

S. No.	Teacher's Activity	Students Activity				Students Answer
		Right Hand	Left Hand	R. Hand	L. Hand	
1.	10 + 4 + 2 = ?	10 	4+ 5 - 3 			16
2.	10 + 20 + 20 + 3 + 4 = ?	10 + 20 +50 - 30 	3 + 5 - 1 			57
3.	30 + 3 + 3 + 40 = ?	30 + 50 - 10 	3 + 5 - 2 			76

Exercise 1:

10 + 10 + 40 = ?
30 + 4 + 2 + 20 + 1 = ?
40 + 10 + 10 + 3 + 2 + 20 = ?
40 + 20 + 1 + 4 + 10 + 20 + 2 = ?
22 + 12 + 3 + 1 = ?

10 + 10 + 50 – 10 = 60
30 + 4 + 5 – 3 + 50 – 30 + 1 = 57
40 + 50 – 40 + 10 + 3 + 5 - 3 + 20 = 85
40 + 50 – 30 + 1 + 5 - 1 + 20 + 2 = 93
22 + 12 + 5 - 2 + 1 = 38

Level 2: Using Fingers With Closed Eyes

A. Using the Fingers of Right Hand (Ones / Single digits)
B. Using the Fingers of Left Hand (Tens / Double digits)
C. Using the Fingers of Both Hands (Single & Double digits)

Level 3: Using Fingers With Hands Behind

A. Using the Fingers of Right Hand (Ones / Single digits)
B. Using the Fingers of Left Hand (Tens / Double digits)
C. Using theFingers of Both Hands (Single & Double digits)

Level 4: Visualization

MODULE VI: COMBINATION IN ADDITION & SUBTRACTION

Level 1: Using Fingers of the Hands

A. Using the Fingers of Right Hand (Ones / Single digits)
B. Using the Fingers of Left Hand (Tens / Double digits)
C. Using the Fingers of Both Hands (Single & Double digits)

Level 2: Using Fingers With Closed Eyes

D. Using the Fingers of Right Hand (Ones / Single digits)

E. Using the Fingers of Left Hand (Tens / Double digits)
F. Using the Fingers of Both Hands (Single & Double digits)

Level 3: Using Fingers With Hands Behind

D. Using the Fingers of Right Hand (Ones / Single digits)
E. Using the Fingers of Left Hand (Tens / Double digits)
F. Using theFingers of Both Hands (Single & Double digits)

Level 4: Visualization

MODULE VI: COMBINATION IN ADDITION & SUBTRACTION

Level 1: Using the Fingers of Hands

A. **Using the Fingers of Right Hand (Ones / Single digits)**

Example 1:

S. No.	Exercise	Teacher's Activity	Students' Activity	Process	Answer
1.	12 + 4	To add 4 what should we do?	To add 4, open 5 and close 1 (5 – 1)	10 + 2 + 5 – 1	16
2.	36 + 6	To add 6, what shall we do/	To add 6, we open 10 and close 5 and open 1 (10 – 5 + 1)	30 + 5 + 1 + 10 – 5 + 1	42
3.	14 – 6	To subtract 6, what shall we do?	To subtract 6, we close 10 and open five and close 1. (-10 + 5 – 1)	10 + 4 – 10 + 5 - 1	8

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LIST OF M. ED DISSERTATIONS FOR THE YEAR 2018-19

S.L. NO.	REG. NO	NAME OF THE STUDENT	TOPIC OF THE DISSERTATION	NAME OF THE GUIDE
1.	512M Y19MED0201	AGASTENAMA .D	YENIMIDAVA THARAGATHI TELUGU VACHAKAMU - PARISEELANA	DR. J. VIJAYA KUMARI
2.	513M Y19MED0202	LEENA EJ	A STUDY ON CO-CURRICULAR ACTIVITIES AND PERSONALITY DEVELOPMENT OF SECONDARY SCHOOL PUPILS	DR. SK. AKTHARUNNISA BEGUM

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Yoga Package

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Experimental Packages produced by the Scholars

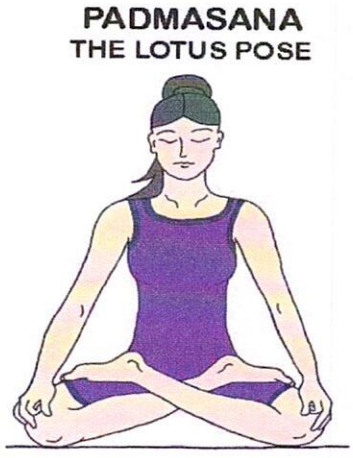
Experimental Treatment

The following are yoga package taught to the students' every day for 40 to 45 minutes for the experimental group.

Yoga package contains practice in Hatha yoga in the form of three different asanas as follows.

1. Meditative asana for 10 to 15 minutes

i) Padmasana or lotus



- **Instructions to Lotus Pose - Padmasana**

- Sit on the floor with your legs straight in front. ...
- Bend the left knee and turn the leg out. ...
- Now lean back slightly, pick the right leg up off the floor, and lift the left leg in front of the right. ...
- Padmasana is the sitting asana par excellence, but it's not for everybody.

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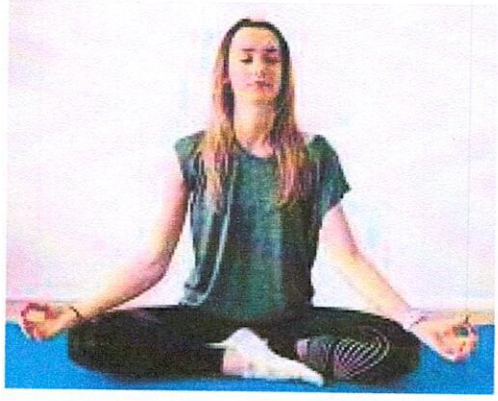
- **Benefits of Lotus Pose – Padmasana:**

- Opens up the hips.
- Stretches the ankles and knees.
- Calms the brain.
- Increases awareness and attentiveness.
- Keeps the spine straight.
- Helps develop good posture.
- Eases menstrual discomfort and sciatica.
- Helps keeps joints and ligaments flexible.

ii) Siddhasana or adept's pose



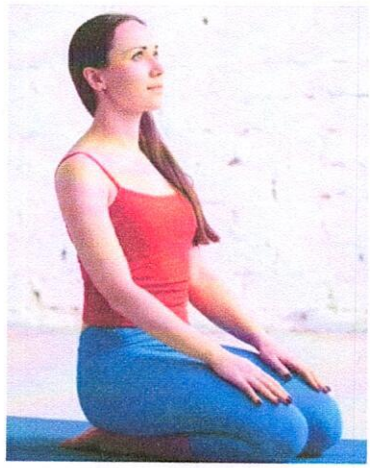
- **Instructions of Siddhasana or adept's pose**

- Bend your left knee and bring your left heel in toward the groin area.
- Rest your heel along the perineum, the spot at the base of your spine between the anus and the genitals.
- Bend the right leg and draw your right heel in.
- Place your right, outer ankle over the inner ankle of your left foot.

- **Benefits of Siddhasana or adept's pose**

  - One of the best asanas for meditation.
  - Better flow of energy through the body, especially in the spinal region.
  - The chakras of 'Mooladhara' and 'Swadhistana' are stimulated.

iii) Vajrasana for people who cannot sit cross-legged:



- **Instructions of Vajrasana pose**

  - Thighs and adjust your pelvis slightly backward and forward until you're comfortable. Start by kneeling on the floor. ...
  - Pull your knees and ankles together and point your feet in line with your legs. ...
  - Exhale as you sit back on your legs. ...
  - Put your hands on your

- **Benefits of Vajrasana pose**

  - Helping keep the mind calm and stable.
  - Curing digestive acidity and gas formation.
  - Helping to relieve knee pain.
  - Strengthening thigh muscles.

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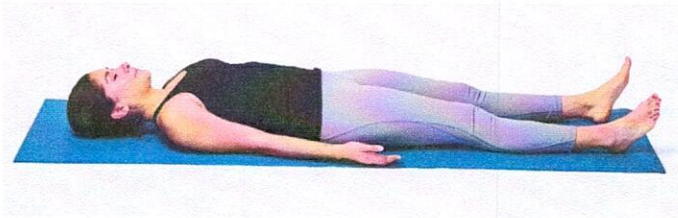
2. Relaxation Asanas for 10 to 15 minutes

i) Savasana or corpse pose



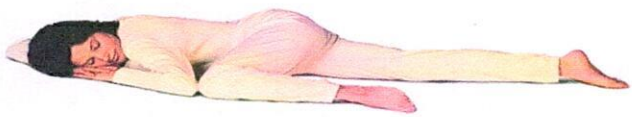
- **Instructions of Savasana or corpse pose**

- Lying on your back, let the arms and legs drop open, with the arms about 45 degrees from the side of your body. ...
- Close the eyes, and take slow deep breaths through the nose. ...
- Scan the body from the toes to the fingers to the crown of the head, looking for tension, tightness and contracted muscles.

- **Benefits of Savasana or corpse pose**

- Calms the brain and helps relieve stress and mild depression.
- Relaxes the body.
- Reduces headache, fatigue, and insomnia.
- Helps to lower blood pressure.

ii) Abdominal relaxation pose



Instructions of abdominal relaxation pose

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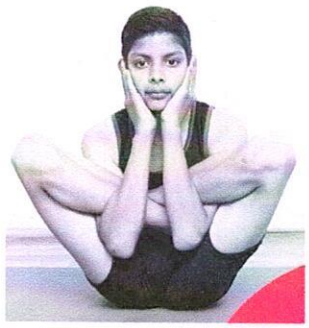
- Breathing in, raise both the hands, legs, head and chest simultaneously to their maximum possible height.
- Rest the entire weight of the body on stomach and navel.
- After being in this state for 5 to 10 seconds, relax the body to normal position breathing out. Repeat it 3 to 5 times.

- **Benefits of Abdominal relaxation pose**

- Relaxes your shoulders and back.
- It stretches your hip muscles, treats hypertension, and relieves fatigue.

iii) Garbhasana



- **Instruction of Garbhasana**

- Firstly align in Lotus Pose (Padmasana). ...
- From here inhale, lift the legs up and bring the hands through the legs.
- Exhale and bring the arms out and place the hands on the face at the chin. ...
- You are balancing on your sit bones so keep the breath awareness to maintain the balance.

Benefits of Garbhasana:

- Has a regulating effect on the adrenal glands and calms an excited mind.
- Alleviates nervous disorders.
- Helps to control anger.
- Massages and tones the abdominal organs.

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- Stimulates the digestive fire and increases the appetite.
- Improves sense of balance.

iv) Balasana or child's pose

- **Instructions of Balasana or child's pose**

- Begin on your hands and knees. ...
- Spread your knees wide apart while keeping your big toes touching. ...
- Sit up straight and lengthen your spine up through the crown of your head.
- On an exhalation, bow forward, draping your torso between your thighs. ...
- Keep your arms long and extended, palms facing down.

- **Benefits of Balasana or child's pose**

- Helps relieve fatigue. ...
- For the reasons mentioned above, this is also a great pose to ease anxiety and stress. ...
- The pose helps lengthen and stretch out the spine.
- It also gently stretches the ankles, hips and shoulders.
- Stimulates digestion and elimination.

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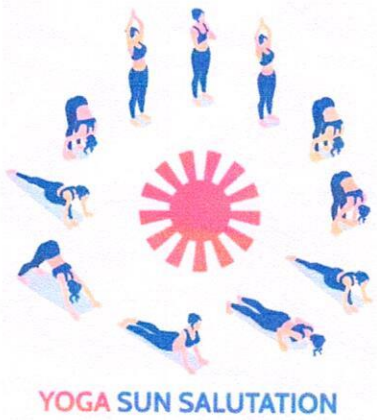
3. Cultural asanas for 10 to 15 minutes.

i) Dynamic sequences - such as the sun salutation



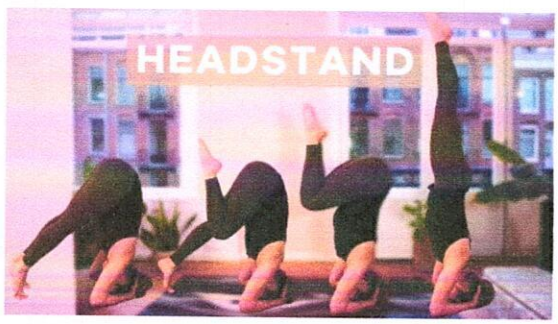
- **Instructions of sun salutation**

- Place your feet together at the top of the mat, pressing into the ground.
- Touch your hands overhead, lifting your ribs off of your waist.
- Fold forward keeping length in your spine.
- Touch your hands to the ground in line with your toes, or to your shins to stretch your back.

- **Benefits of sun salutation**

- Unwinds the Mind and Body. Stress is not a phenomenon unfamiliar in modern day life. ...
- Ensures Heart Health and Boosts Immunity. ...
- Effective for Weight Loss. ...
- Relief from Hair Fall. ...

ii) Inverted postures - such as the headstand or the shoulder stand:



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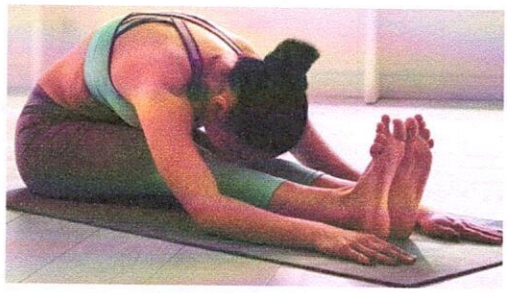
- **Instructions of headstand or the shoulder stand**

- Lying on your back, tuck your shoulder blades under.
- Lift your legs to 90 degrees and pause. ...
- Lack your fingers behind your back and straighten your arms.
- Roll your shoulders under one at a time.
- It's hard to breathe in this position, but try to stay for five deep breaths

- **Benefits of headstand or the shoulder stand:**

- The health benefits of these two poses cannot be overemphasized!
- Your organs and glands get bathed in blood, absorb nutrients from the blood and secret hormones for proper functioning of a well-balanced body and brain.
- Headstand - Sirsansa& Shoulder Stand - Sarvangasana are a panacea for most common ailments.

iii) Forward bending postures - such as the sitting forward bend aka Paschimottan asana:



- **Instructions of Paschimottan asana.**

- Bring your arms straight out to the sides and up over your head, reaching toward the ceiling.
- Inhale and draw your spine up long.
- As you exhale, begin to come forward, hinging at your hips.
- On each inhale, lengthen your spine. ...
- On each exhale, deepen into your forward bend.

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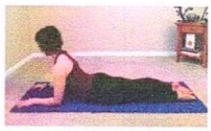
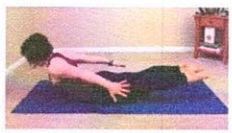
- **Benefits of Paschimottan asana.**

- Calms the brain and helps relieve stress and mild depression.
- Stretches the spine, shoulders, hamstrings.
- Stimulates the liver, kidneys, ovaries, and uterus.
- Improves digestion.

iv) Backward bending postures - such as the cobra, locust, or bow poses


- **Instructions of cobra pose**

- Lie prone on the floor. ...
- Press the tops of the feet and thighs and the pubis firmly into the floor. ...

- **Instructions of locust pose**

- Begin lying on your stomach with your arms at your sides. Rest your forehead on the mat.
- Inhale and raise your head to look forward. ...
- Use your inner thighs to lift your legs up toward the ceiling. ...

- **Instructions of bow pose**

- Lie on your belly with your hands alongside your torso, palms up. ...
- Inhale and strongly lift your heels away from your buttocks and, at the same time, lift your thighs away from the floor. ...

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- **Benefits of Backward bending postures - such as the cobra , locust , or bow poses**

- Calms the brain and helps relieve stress and mild depression.
- Stretches the spine, shoulders, and hamstrings.
- Stimulates the liver, kidneys, ovaries, and uterus.
- Improves digestion.

v) Twisting postures - such as the half spinal twist

- **Instructions of half spinal twist**

- Legs bent. Sit up on your heels. Drop your buttocks to the floor, to the left of your legs.
- Leg position. Bend your right leg. ...
- The twist. Lower your left arm, bringing it outside your bent knee, and then grasp your right ankle.

- **Benefits of Twisting postures - such as the half spinal twist**

- It increases spinal rotation
- Boosts blood flow to the disks, and builds strength and flexibility in the erector spine muscles,
- Tiny muscles that support the spine.

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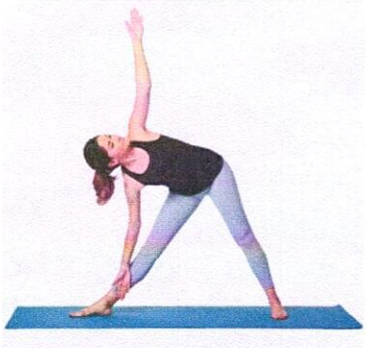
vi) Sides ward bending postures - such as the triangle pose.



- **Instructions of side triangle pose.**

- Begin standing at the top of your mat with your feet hip-distance apart and your arms at your sides. ...
- Step your feet wide apart, about 4 to 5 feet. ...
- Turn your right foot out 90 degrees so your toes are pointing to the top of the mat. ...
- Pivot your left foot slightly inwards.

- **Benefits of side triangle pose.**

- Stretches legs, muscles around the knee, ankle joints, hips, groin muscles, hamstrings, calves, shoulders, chest and spine.
- Strengthens legs, knees, ankles, abdominals, obliques and back.
- Stimulates function of abdominal organs.
- Relieves stress.

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