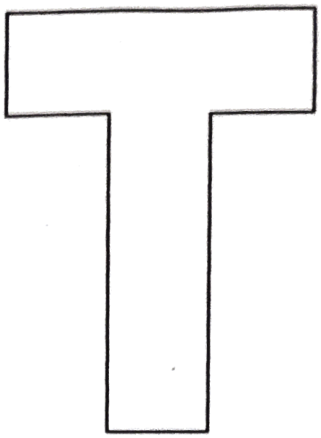

The T.Serge Algorithm (Pseudocode)

The following algorithm, includes step by step equation transformation like arranging constants and variables on rows and columns just as a matrix, and sums the rows to equate them to the total sum of constants in the equation to get solution as $x_1 = s_1, \ldots, x_n = s_n$

We have this linear equation: $a_1x_1 + a_2x_2 + a_3x_3 + \cdots a_nx_n + a_o = 0$

Step 1:

i. If an equation has even number of variables, both left and right hand side will have equal number of variables. i.e.: $x_1 + x_2 + \cdots + x_{(n-1)} = x_{\left(\frac{n}{2}\right)+1} + x_{\left(\frac{n}{2}\right)+2} + \cdots + x_n$

ii. Else if the number of variables is odd, the left hand side will have one more variable than the right hand side i.e.: $x_1 + x_2 + \cdots + x_{\left(\frac{n}{2}\right)-1} = x_{\left(\frac{n}{2}\right)-2} + x_{\left(\frac{n}{2}\right)-1} + \cdots + x_n$

iii. When the given line... a_o or/and b_o each must remain in its/their side(s) as was given, they must not be displaced ... accept when it is instructed.

This is a general...

$$a_1x_1 \ldots x_n + a_o = b_1x_{n-1} + b_2x_{n-2} + b_3x_{n-3} + \cdots b_nx_{n-n} + b_o$$

Step 2:

i. ... hand side variables and their coefficients on the row1 and each on its ... from the right hand side you put them on the row2 and column1 to n

ii. ... matrix at row1 and column1 and b_o on row2, column1. Add the ... in the right hand side in a block of (2x1) matrix on the row1, ...

$$\begin{vmatrix} a_nx_n \\ b_{n-n}x_{n-n} \end{vmatrix} \begin{vmatrix} a_o \\ b_o \end{vmatrix} = \begin{vmatrix} a_o + b_o \\ a_o + b_o \end{vmatrix}$$

... the constants a_o or b_o according to the row position and ... those will be named equation1 to n.

$$\ldots + a_2 \qquad a_o = a_o + b_o \quad \ldots\ldots (eqn1)$$

$$\ldots x_{n-2} + b_3x_{n-3} \qquad \ldots + b_o = a_o + b_o \quad \ldots\ldots (eqn2)$$

... calculate its final value. Else if any of the equations

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$$a_1x_1 + a_0 = b_0 + b_1x_2 \quad \text{----(i)}$$

TSF	a_0	b_0	a_0+b_0
a_1x_1	$a_0+a_1x_1$	$b_0 - a_1x_1$	
b_1x_2	$a_0 - b_1x_2$	$b_0+b_1x_2$	

$$a_0 + a_1x_1 = a_0 + b_0$$

$$a_1x_1 = a_0 + b_0 - a_0$$

$$a_1x_1 = b_0$$

$$\boxed{x_1 = \frac{b_0}{a_1}}$$

$$b_0 + b_1x_2 = a_0 + b_0$$

$$b_1x_2 = a_0 + b_0 - b_0$$

$$\frac{b_1x_2}{b_1} = \frac{a_0}{b_1}$$

$$\boxed{x_2 = \frac{a_0}{b_1}}$$

2D

My equation for two un

General Formular

$\Rightarrow a_1x_1 + \cdots a_m x_m + a_0 + k = b_1 x_{m+1} + b_2 x_{m+2} \cdots b_n x_{m+n} + b_0 + k$

$$x_1 = \frac{\cancel{a_0} + b_0 - \cancel{a_0}}{a_1} \qquad x_1 = \frac{b_0}{a_1}$$

$$x_2 = \frac{a_0 + \cancel{b_0} - \cancel{b_0}}{b_1} \qquad x_2 = \frac{a_0}{b_1}$$

Example

$$2x + 20 = 40 - y$$

$$x_1 = \frac{40}{2} \qquad \underline{\underline{x_1 = 20}}$$

$$x_2 = \frac{20}{-1} \qquad \underline{\underline{x_2 = -20}}$$

Prove: $2(20) + 20 = 40 - (-20)$

$$\underline{\underline{60 = 60}}$$

Conclusion: 1. The formula for two unknown/2D

$$a_1x_1 + a_0 + k = b_1x_2 + b_0 + k \quad \text{---(i)}$$

$$a_1x_1 + a_2x_2 + a_0 = b_1x_3 + b_0 \quad \text{---(ii)}$$

TSF	a_0	b_0	$a_0 + b_0$
$a_1x_1 + a_2x_2$	$a_1x_1 + a_2x_2 + a_0$	$b_0 - (a_1x_1 + a_2x_2)$	
b_1x_3	$a_0 - b_1x_3$	$b_1x_3 + b_0$	

~~$a_1x_1 + a_2x_2 + a_0 = a_0 + b_0$~~

$$a_1x_1 + a_2x_2 + a_0 = a_0 + b_0$$

$$a_1x_1 + a_0 = a_0 + b_0 - a_2x_2 \quad \text{---(iii)}$$

TSF	a_0	$a_0 + b_0$	$2a_0 + b_0$
a_1x_1	$a_1x_1 + a_0$	$a_0 + b_0 - a_2x_2$	
$-a_2x_2$	$a_0 + a_2x_2$	$a_0 + b_0 + a_2x_2$	

$$a_1x_1 + a_0 = 2a_0 + b_0$$

$$\frac{a_1x_1}{a_1} = \frac{a_0 + b_0}{a_1}$$

$$x_1 = \frac{a_0 + b_0}{a_1}$$

$$a_0 + b_0 + a_2x_2 = 2a_0 + b_0$$

$$x_2 = \frac{a_0}{-a_2}$$

$$b_1x_3 + b_0 = a_0 + b_0$$

$$x_3 = \frac{a_0}{b_1}$$

3D

General formula

$$a_1x_1 + a_2x_2 + \cdots + a_mx_m + k + a_0 = b_1x_{m+1} + b_2x_{m+2} + \cdots + b_nx_{m+n} + k + b_0$$

$$x_1 = \frac{a_0 + b_0}{a_1}, \quad x_2 = \frac{a_0}{-a_2}, \quad x_3 = \frac{a_0}{b_1}$$

Example:

$$6y + 2x + 18 = 4z + 16$$
$$2x + 6y + 18 = 4z + 16$$

$$x = \frac{18 + 16}{2} = \frac{34}{2} = 17$$

$$y = \frac{18}{-6} = -3$$

$$z = \frac{18}{4} = \frac{9}{2}$$

Prove: $2(17) + 6(3) + 18 = 4(\frac{9}{2}) + 16$

$$34 + 18 + 18 = 18 + 16$$
$$34 = 34$$

Conclusion: 1. The formular for three Unknowns / 3D.

$$a_1x_1 + a_2x_2 + a_0 + k = b_1x_3 + b_0 + k$$

LHS has Unknowns $K+1$ where RHS has K Unk

$$a_1 x_1 + a_2 x_2 + a_0 = b_0 + b_1 x_3 + b_2 x_4$$

TSF	a_0	c_{00}	$a_0 + b_0$
$a_1 x_1 + a_2 x_2$	$a_0 + a_1 x_1 + a_2 x_2$	$b_{00} - (a_1 x_1 + a_2 x_2)$	
$b_1 x_3 + b_2 x_4$	$a_0 - (b_1 x_3 + b_2 x_4)$	$b_0 + b_1 x_3 + b_2 x_4$	

$$a_0 + a_1 x_1 + a_2 x_2 = a_0 + b_0$$

$$a_0 + a_1 x_1 = a_0 + b_0 - a_2 x_2 \quad \text{---} \quad \text{(iv)}$$

The equation (iv) = Equation (iii)

So $\boxed{x_1 = \frac{a_0 + b_0}{a_1}}$ $\boxed{x_2 = \frac{a_0}{-a_2}}$

$$\Rightarrow b_0 + b_1 x_3 + b_2 x_4 = a_0 + b_0$$

$$b_0 + b_1 x_3 = a_0 + b_0 - b_2 x_4 \quad \text{---} \quad \text{(v)}$$

Also equation (v) resembles equation (iv)

So, $\boxed{x_3 = \frac{b_0 + a_0}{b_1}}$ $\boxed{x_4 = \frac{b_0}{-b_2}}$.

4D General Formular

$$a_1x_1 + a_2x_2 + \cdots a_mx_m + a_0 + k = b_1x_{m+1} + b_2x_{m+2} + \cdots + b_nx_{m+n} + b_0 + k$$

Example $2x + 14 - 8y = 4z + 18 + 6Q$

$$x_1 = \frac{14+18}{2} = \frac{32}{2} = \underline{16}$$

$$y = \frac{14}{8} = \underline{\frac{7}{4}}$$

$$z = \frac{18+14}{4} = \frac{32}{4} = \underline{8}$$

$$Q = \frac{18}{-6} = \underline{-3}$$

Proof. $2(16) + 14 - 8\left(\frac{7}{4}\right) = 4(8) + 18 + 6(-3)$

$32 + 14 - 14 = 32 + 18 - 18$

$32 = 32$.

Conclusion: The formular for four Unknown / 4D .

$$a_1x_1 + a_2x_2 + a_0 + k = b_1x_3 + b_2x_4 + b_0 + k$$

$$a_1x_1+a_2x_2+a_3x_3+a_0 = b_1x_4+b_2x_5+b_0$$

TSF	a_0	b_0	a_0+b_0
$a_1x_1+a_2x_2+a_3x_3$	$a_0+a_1x_1+a_2x_2+a_3x_3$	$b_0-(a_1x_1+a_2x_2+a_3x_3)$	
$b_1x_4+b_2x_5$	$a_0-(b_1x_4+b_2x_5)$	$b_0+b_1x_4+b_2x_5$	

$\Rightarrow$ $a_0+a_1x_1+a_2x_2+a_3x_3 = a_0+b_0$

$$a_0+a_1x_1+a_2x_2 = a_0+b_0-a_3x_3 \quad \text{---(vi)}$$

TSF	a_0	a_0+b_0	$2a_0+b_0$
$a_1x_1+a_2x_2$	$a_0+a_1x_1+a_2x_2$	$a_0+b_0-(a_1x_1+a_2x_2)$	
$-a_3x_3$	$a_0+a_3x_3$	$a_0+b_0-a_3x_3$	

$$a_0+a_1x_1+a_2x_2 = 2a_0+b_0$$

$$a_0+a_1x_1 = 2a_0+b_0-a_2x_2 \quad \text{----(vii)}$$

From equation (vii) reversibles equation (iv)

$$\boxed{x_1 = \frac{2a_0+b_0}{a_1}} \qquad \boxed{x_2 = \frac{a_0}{-a_2}}$$

$$a_0+\cancel{b_0}-a_3x_3 = 2a_0+\cancel{b_0}$$

$$\frac{-a_3x_3}{-a_3} = \frac{a_0}{-a_3} \qquad \boxed{x_3 = \frac{a_0}{-a_3}}$$

5D General formulas

$$a_1x_1 + a_2x_2 + \cdots + a_mx_m + a_0 + k = b_1x_{m+1} + b_2x_{m+2} + \cdots + b_nx_{m+n} + b_0 + k$$

$$\Rightarrow b_0 + b_1x_4 + b_2x_5 = a_0 + b_0$$

$$b_0 + b_1x_4 = a_0 + b_0 - b_2x_5 \quad \text{---} \quad (viii)$$

equation (viii) resembles (iii) & (iv) & (vii)

$$\boxed{x_4 = \frac{a_0 + b_0}{b_1}} \qquad \boxed{x_5 = \frac{b_0}{-b_2}}$$

Example $2x + 12 - 2z + 3y = 24 + 6Q - T$

$$x_1 = \frac{(2(12) + 24)}{2} = \frac{48}{2} = 24$$

$$z_2 = \frac{12}{2} = 6 \qquad y = \frac{12}{-3} = -4$$

$$Q = \frac{12 + 24}{6} = \frac{36}{6} = 6 \qquad T = \frac{24}{1} = 24$$

Proof: $2(24) + \cancel{12} - 2(6) + 3(-4) = \cancel{24} + 6(6) - \cancel{24}$

$$48 - 12 = 36$$

$$36 = 36$$

Conclusion: The formula for five unknowns / 5D

$$a_1x_1 + a_2x_2 + a_3x_3 + a_0 + k = b_1x_4 + b_2x_5 + b_0 + k$$

$K + 1 = K \Rightarrow$ Number of unknowns

$2x + 2y + z + 2w = 8$

$\boxed{k = 4}$

$2x + 2y + z + 2w + 4 = 8 + 4$

$3x + 2y + z + 2w + 4 = 12$

$2x + 2y + z + 4 = 12 - 2w$

$\begin{vmatrix} 2x+2y+z \\ -2w \end{vmatrix} \begin{vmatrix} A \\ 12 \end{vmatrix} = \begin{vmatrix} 16 \\ 16 \end{vmatrix}$

$-2w + 12 = 16$

$-2w = 4$

$\boxed{w = -2}$

$2x + 2y + z + 4 = 16.$

$2x + 2y + 4 = 16 - z$

$\begin{vmatrix} 2x+2y \\ -z \end{vmatrix} \begin{vmatrix} 4 \\ 16 \end{vmatrix} = \begin{vmatrix} 20 \\ 20 \end{vmatrix}$

$-z + 16 = 20$

$-z = 4$

$\boxed{z = -4}$

$2x + 2y + 4 = 20$

$2x + 4 = 20 - 2y$

$\begin{vmatrix} 2x \\ +2y \end{vmatrix} \begin{vmatrix} 4 \\ 20 \end{vmatrix} = \begin{vmatrix} 24 \\ 24 \end{vmatrix}$

$2x + 4 = 24$

$2x = 20$

$\boxed{x = 10}$

$-2y + 20 = 24$

$-2y = 4$

$\boxed{y = -2}$

$\boxed{w = \frac{a_0}{-a_4}}$ $\boxed{z = \frac{a_0}{-a_3}}$

$\boxed{y = \frac{a_0}{-a_2}}$ $\boxed{x = \frac{2a_0 + b_0}{a_1}}$

$2(10) + 2(-2) + (-4) + 2(-2) = 8$

$20 - 4 - 4 - 4 = 8$

$20 - 12 = 8$

$\boxed{8 = 8}$

$-2 \times \frac{a_0}{-2}$ $\boxed{a_0 = 4}$

$\frac{2a_0 + b_0}{a_1} = x \Rightarrow a_0 = \frac{a_1 x - b_0}{2}$

$a_0 = \frac{20 - 8}{3}$ $\boxed{a_0 = 4}$

$3x+6y+z+w=12$

$x=\frac{3a_0+b}{a_1}=\frac{12}{3}=4$

$y=\frac{a_0}{a_2}=\frac{0}{6}=0$

$z=\frac{a_0}{a_3}=\frac{0}{1}=0$

$w=\frac{a_0}{a_4}=\frac{0}{1}=0$

$k=0$ and $k=a_0$

$8x+6y+z+w+4=16$

$x=\frac{12+16}{3}=\frac{24}{3}=8$

$y=\frac{4}{6}=-2/3$

$z=\frac{4}{1}=-4$

$w=\frac{4}{1}=-4$

$3(8)+6(-4/6)+4+4$

$24+4+4+4=$

$24-4-4-4=12$

$24-12=12$

$2x+2y+z+2w=8$

$w=4\ z=-4\ y=-2\ x=4$

$2(4)+2(-2)+(-4)+2(4)=8$

$8-4-4+8=8$

$8=8$

$w=\frac{a_0}{-a_4}\quad z=\frac{a_0}{-a_3}\quad y=\frac{a_0}{-a_2}\quad x=\frac{3a_0+b_0}{a_1}$

$x=\frac{3a_0+b_0}{a_1}\quad 3a_0+b_0=a_1x\quad 3a_0=a_1x-b_0$

$3a_0=2(4)-8\quad 3a_0=0\quad a_0=0$

$w=\frac{a_0}{-a_4}\quad a_0=-a_4w\quad a_0=-2(4)\quad a_0=-8$

$z=\frac{a_0}{-a_3}\Rightarrow a_0=-a_3z=-1(-1)\quad a_0=+1$

$y=\frac{a_0}{-a_2}\Rightarrow a_0=-a_2y=-2(-2)\quad a_0=4$

$3a_0=\frac{a_1x-b_0}{2}\quad a_0=\frac{8-0}{2}$

$a_0=-2(4)\quad a_0=-8$

$a_0=4$

$$2x+2y+z-8=8-8-2w$$

$$\begin{vmatrix} 2x+2y+z \\ -2w \end{vmatrix} \begin{vmatrix} -8 \\ 0 \end{vmatrix} = \begin{vmatrix} -8 \\ -8 \end{vmatrix}$$

$$-2w=-8$$

$$\boxed{w=4}$$

$$2x+2y+z-8=-8$$

$$2x+2y+z=0.$$

$$2x+2y+z+4=4.$$

$$2x+2y+4=4-z.$$

$$\begin{vmatrix} 2x+2y \\ -z \end{vmatrix} \begin{vmatrix} 4 \\ 4 \end{vmatrix} = \begin{vmatrix} 8 \\ 8 \end{vmatrix}$$

$$-z+4=8$$

$$-z=4 \quad \boxed{z=-4}$$

$$2x+2y+4=8.$$

$$2x+4=8-2y$$

$$2x+2=6-2y$$

$$\begin{vmatrix} 2x \\ -2y \end{vmatrix} \begin{vmatrix} 2 \\ 6 \end{vmatrix} = \begin{vmatrix} 8 \\ 8 \end{vmatrix}$$

$$\begin{vmatrix} 2x \\ -2y \end{vmatrix} \begin{vmatrix} 4 \\ 8 \end{vmatrix} = \begin{vmatrix} 12 \\ 12 \end{vmatrix}$$

$$-2y=4 \quad \boxed{y=-2}$$

$$2x+4=12$$

$$2x=8$$

$$\boxed{x=4}$$

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$x + y = 4$

$x + y + 4 = 0$

$x + 4 = -y$

$\begin{vmatrix} x \\ y \end{vmatrix} \begin{vmatrix} -4 \\ 0 \end{vmatrix} = \begin{vmatrix} -4 \\ -4 \end{vmatrix}$

$\boxed{y = +4}$

$x + 4 = 4$

$\boxed{x = 0}$

$\boxed{x = \frac{a_0 + b_0}{a_1}}$

$\boxed{y = \frac{a_0}{-a_2}}$ $\boxed{x = \frac{b_0 - a_0}{a_1}}$

$2x + 2y + 4 = 4$

$2x + 4 = 4 - 2y$

$\begin{vmatrix} 2x \\ -2y \end{vmatrix} \begin{vmatrix} 4 \\ -4 \end{vmatrix} = \begin{vmatrix} -8 \\ -8 \end{vmatrix}$

$2x + 4 = 8$

$2x = 4$

$\boxed{x = 2}$

$-2y + 4 = 8$

$-2y = 4$

$\boxed{y = +2}$

$2x + 2y + z = 4$

$2x + 2y + z + 4 = 0$

$2x + 2y + 4 = -z$

$\begin{vmatrix} 2x + 2y \\ -z \end{vmatrix} \begin{vmatrix} -4 \\ 0 \end{vmatrix} = \begin{vmatrix} -4 \\ -4 \end{vmatrix}$

$\boxed{z = +4}$

$2x + 2y + 4 = 4$

$2x + 2y + 4 = 4$

$2(2) + 2(+2) + (+4) = 4$

$4 + 4 - 4 - 4 = 4$

$-4 + 4 + 4 = 4$

$\boxed{4 = 4}$

$\boxed{y = \frac{a_0}{-a_2}}$ $\boxed{z = \frac{a_0}{-a_3}}$

$\boxed{x = \frac{a_0 + b_0}{a_1}}$

G = Number of Matrices Minus One

$\boxed{G = n - 1}$

$\boxed{x = \frac{ma_0 + b_0}{a_1}}$

$\boxed{m = D + 1}$

number of Matrices equal to Dimensions minus One

$2x+2y+2z+w-4=0$

$2x+2y+2z-4=-w$

$\begin{vmatrix} 2x+2y+2z \\ -w \end{vmatrix} \begin{vmatrix} -4 \\ 0 \end{vmatrix} = \begin{vmatrix} -4 \\ -4 \end{vmatrix}$

$\boxed{w=4}$

$2x+2y+2z-4=-4.$

$2x+2y-4=-4-2z$

$\begin{vmatrix} 2x+2y \\ -2z \end{vmatrix} \begin{vmatrix} -4 \\ -4 \end{vmatrix} = \begin{vmatrix} -8 \\ -8 \end{vmatrix}$

$-2z-4=-8$

$-2z=-4$

$\boxed{z=2}$

$2x+2y-4=-8$

$2x-4=-8-2y$

$\begin{vmatrix} 2x \\ 2y \end{vmatrix} \begin{vmatrix} -4 \\ -8 \end{vmatrix} = \begin{vmatrix} -12 \\ -12 \end{vmatrix}$

$2x-4=-12$

$2x=-8$

$\boxed{x=-4}$

$-2y-8=-12$

$-2y=-4$

$\boxed{y=2}$

$\begin{vmatrix} 2x \\ 2y \end{vmatrix} \begin{vmatrix} -8 \\ -20 \end{vmatrix} = \begin{vmatrix} -28 \\ -28 \end{vmatrix}$

$2x=-20$

$\boxed{x=-10}$

$\boxed{x=\frac{-16-4}{2}}$

$2(-4)+2(2)+2(2)+(4)=0$

$-8+4+4+4=4=0$

$-8+8+4-4=0$

$\boxed{0=0}$

$\boxed{w=\frac{a_0}{-a_4}}$ $\boxed{z=\frac{a_0}{-a_3}}$

$\boxed{y=\frac{a_0}{-a_2}}$ $\boxed{x=\frac{2a_0+b_0}{a_1}}$

$2x+2y+2z+w-4=0$

$2x+2y+2z+w-8=-4$

$\boxed{w=8}$ $\boxed{z=4}$ $\boxed{y=4}$

$2x+2y+2z+8=-4-w$

$\begin{vmatrix} 2x+2y+2z \\ -w \end{vmatrix} \begin{vmatrix} -8 \\ -4 \end{vmatrix} = \begin{vmatrix} -12 \\ -12 \end{vmatrix}$

$-w-4=-12$

$-w=-8$

$\boxed{w=8}$

$2x+2y+2z-8=-12$

$2x+2y-8=-12-2z$

$\begin{vmatrix} 2x+2y \\ -2z \end{vmatrix} \begin{vmatrix} -8 \\ -12 \end{vmatrix} = \begin{vmatrix} -20 \\ -20 \end{vmatrix}$

$-2z-12=-20$

$-2z=-8$

$\boxed{z=4}$

$2x+2y+2z+w+Q-8=0$

$2x+2y+2z+w-8=-Q$

$\begin{vmatrix} 2x+2y+2z+w \\ -Q \end{vmatrix} \begin{vmatrix} -8 \\ 8 \end{vmatrix} = \begin{vmatrix} -8 \\ -8 \end{vmatrix}$

$\boxed{Q=8}$

$2x+2y+2z+w-8=-8$

$2x+2y+2z-8=-8-w$

$\begin{vmatrix} 2x+2y+2z \\ -w \end{vmatrix} \begin{vmatrix} -8 \\ -8 \end{vmatrix} = \begin{vmatrix} -16 \\ -16 \end{vmatrix}$

$-w-8=-16$

$-w=-8$

$\boxed{w=8}$

$2x+2y+2z-8=-16$

$2x+2y-8=-16-2z$

$\begin{vmatrix} 2x+2y \\ -2z \end{vmatrix} \begin{vmatrix} -8 \\ -16 \end{vmatrix} = \begin{vmatrix} -24 \\ -24 \end{vmatrix}$

$-2z-16=-24$

$-2z=-8$

$\boxed{z=4}$

$2x+2y-8=-24$

$2x-8=-24-2y$

$\begin{vmatrix} 2x \\ -2y \end{vmatrix} \begin{vmatrix} -8 \\ -24 \end{vmatrix} = \begin{vmatrix} -32 \\ -32 \end{vmatrix}$

$-2y-24=-32$

$-2y=-8$

$\boxed{y=4}$

$2x-8=-32$

$2x=-24$

$\boxed{x=-12}$

$\boxed{Q=\frac{Q_0}{Q_5}}$ $\boxed{w=\frac{Q_0}{Q_4}}$ $\boxed{z=\frac{Q_0}{Q_3}}$

$\boxed{y=\frac{Q_0}{Q_2}}$ $\boxed{x=\frac{3Q_0+b_0}{Q_1}}$

Rules $\boxed{x=\frac{CQ_0+b_0}{Q_1}}$

Where C represents number of Additional Matrices which equals to the number of Matrices minus one

$\boxed{C=n-1}$

And number of Matrices are obtained from the dimension Size minus One

$\boxed{n=D-1}$

If we have 9D, matrices will be 8 and from there C will be equal to 7

$2x + y = 4$

$2x + y - 4 = 0$

$x = 4$ $\quad y = -4$

$y = \frac{a_0}{-a_2}$

$x = \frac{ca_0 + b_0}{a_1}$

$a_0 = -a_1 y$

$a_0 = -1(-4)$

$\boxed{a_0 = 4}$

$ca_0 + b_0 = a_1 x$

$ca_0 = a_1 x - b_0$

$2x + y - 4 + 8 = 8$

$2x + y + 4 = 8$

$2x + 4 = 8 - y$

$\begin{vmatrix} 2x \\ -y \end{vmatrix} \begin{vmatrix} 4 \\ 8 \end{vmatrix} = \begin{vmatrix} 12 \\ 12 \end{vmatrix}$

$-y + 8 = 12$

$-y = 4$ $\quad \boxed{y = -4}$

$2x + 4 = 12$

$2x = 8$

$\boxed{x = 4}$ ✓

initial $a_0 = -4$.

Target $a_0 = 4$.

$ia_0 + k = ta_0$

$\boxed{k = ta_0 - ia_0}$

$k = 4 - (-4)$

$\boxed{k = 8}$.

ta_0 is deduced from the formular for $x, y, :-$ etc where a_0 is one of the parameters in the formulae.

$2x+2y+z=8$

$2x+2y+z-8=0$

$x=2,\ y=4\ \ z=-1$

$y=\frac{a_0}{a_2}\quad a_0=-a_2 y$

$a_0=-2(4)\quad a_0=-8$

$z=\frac{a_0}{-a_3}\quad a_0=-a_3 z$

$a_0=-1(-4)\quad a_0=4$

$2(2)+2(4)+(-1)-8=0$

$4+8-4-8=0$

$0=0$

$x=\frac{a_0+b_0}{a_1}\Rightarrow$

$a_0+b_0=a_1 x$

$a_0=a_1 x-b_0$

$a_0=2(2)-b_0$

$a_0=4$

$y=\frac{4+12}{2}\quad x=\frac{16}{2}$

$x=8$

$2x+2y+z-8=0$

$k=a_0-ia_0$

$k=4-(-8)\Rightarrow k=12$

$2x+2y+z-8+12=12$

$2x+2y+z+4=12$

$2x+2y+4=12-z$

$\begin{vmatrix} 2x+2y \\ -z \end{vmatrix} \begin{vmatrix} 4 \\ 12 \end{vmatrix} = \begin{vmatrix} 16 \\ 16 \end{vmatrix}$

$-z+12=16$

$-z=4$

$z=-4$

$2x+2y+4=16$

$\begin{vmatrix} 2x \\ 2y \end{vmatrix} \begin{vmatrix} 1 \\ 16 \end{vmatrix} = \begin{vmatrix} 20 \\ 20 \end{vmatrix}$

$2y+16=20$

$2y=4\quad y=2$

$2x+4=20$

$2x=16$

$x=8$

$2x + 2y + 4 = 16$

$x = 2 \quad y = 4$

$4 + 8 + 4 = 16$

$16 = 16$

$y = \frac{Q_0}{-Q_2} \quad Q_0 = -2(4)$

$\boxed{Q_0 = -8}$

$x = \frac{}{Q_1}$

$P_k = tQ_0 - iQ_0$

$P_k = -8 - (4)$

$\boxed{P_k = -12}$

$2x + 2y + 4 - 12 = 16 - 12$

$2x + 2y - 8 = 4$

$2x - 8 = 4 - 2y$

$\begin{vmatrix} 2x \\ 2y \end{vmatrix} \begin{vmatrix} -8 \\ 4 \end{vmatrix} = \begin{vmatrix} -4 \\ -4 \end{vmatrix}$

$-2y + 4 = -4$

$-2y = -8 \quad \boxed{y = 4}$

$2x - 8 = -4$

$2x = 4$

$\boxed{x = 2}$

$2x+2y+2z+w+Q-8=0$

$x=2,\ y=-2,\ z=2,\ w=-4\ Q=8$

$2(2)+2(-2)+2(2)+(-4)+(8)-8=0$

$0=0$

$Q=\frac{a_0}{-a_5}$ $\quad a_0=-a_5 Q$

$a_0=-1(8)$ $\boxed{a_0=-8}$

$\boxed{k=ta_0-ia_0}$

$k=-8-(-8)$

$\boxed{k=0}$

$2x+2y+2z+w+Q-8+0=0$

$2x+2y+2z+w-8=0-Q$

$\begin{vmatrix}2x+2y+2z+w\\-Q\end{vmatrix}\begin{vmatrix}-8\\0\end{vmatrix}=\begin{vmatrix}-8\\-8\end{vmatrix}$

$\cancel{-Q=24-16}$ $\quad -Q=-8$

$\boxed{Q=8}$ ✓

$2x+2y+2z+w-8=-8$

$w=\frac{a_0}{-a_4}$ $\quad a_0=-a_4 w$

$a_0=-1(-4)$ $\boxed{a_0=4}$

$\boxed{k=ta_0-ia_0}$

$k=4-(-8)$ $\boxed{k=12}$

$2x+2y+2z+w-8+12=-8+12$

$2x+2y+2z+w+4=4$

$2x+2y+2z+4=4-w$

$\begin{vmatrix}2x+2y+2z\\-w\end{vmatrix}\begin{vmatrix}4\\4\end{vmatrix}=\begin{vmatrix}8\\8\end{vmatrix}$

$-w+4=8$

$-w=4$

$\boxed{w=-4}$ ✓

$2x+2y+2z+4=8$

$z=\frac{a_0}{-a_3}$ $\quad a_0=-a_3 z$

$a_0=-2(2)$ $\boxed{a_0=-4}$

$\boxed{k=ta_0-ia_0}$

$k=-4-(4)$ $\boxed{k=-8}$

$2x+2y+2z+4-8=8-8$

$2x+2y+2z-4=0$

$2x+2y-4=0-2z$

$\begin{vmatrix}2x+2y\\-2z\end{vmatrix}\begin{vmatrix}-4\\0\end{vmatrix}=\begin{vmatrix}-4\\-4\end{vmatrix}$

$-2z=-4$

$\boxed{z=2}$ ✓

$2x+2y-4=-4$

$y=\frac{a_0}{-a_2}$ $\quad a_0=-a_2 y$ $\quad a_0=-2(-2)$

$\boxed{a_0=4}$ $\quad k=ta_0-ia_0$

$k=4-(-4)$ $\boxed{k=8}$

$2x+2y-4+8=-4+8$

$2x+2y+4=4$

$2x+4=4-2y$

$\begin{vmatrix}2x\\-2y\end{vmatrix}\begin{vmatrix}4\\4\end{vmatrix}=\begin{vmatrix}8\\8\end{vmatrix}$

$-2y+4=8$

$\boxed{y=-2}$

$2x+4=8$

$\boxed{x=2}$

Values of k are $k(0,12,-8,8)$

Rwego Algorithm

TSF for Linear & Polynomial

General equation

$$a_1X_1 + a_2X_2 + \cdots a_nX_n + a_0 = b_0$$

where b_0 is initialy equal to zero

$$X_2 \cdots X_n = \frac{a_0}{-a_2 \cdots - a_n}$$ general formular for X_2 to X_n.

$$X_1 = \frac{Ca_0 + b_0}{a_1}$$ where C represents number of additional matrices which equal to the number of matrices minus one $C = m - 1$.

and the number of matrices are obtained from the dimension size minus one $m = D - 1$. If we have 9D, Matrices will be 8 and from there C will be equal to 7.

To find next values of a given equation we use the variable k, $k = ta_0 - ia_0$ where ta_0 represents the target a_0 and ia_0 representing the initial a_0 $k = ta_0 - ia_0$ is used only when we need to direct the solution to a certain known points other wise k value can be randomly picked to find other solution points, so to the general equation adding k will look like: $a_1X_1 + a_2X_2 + \cdots a_nX_n + a_0 + k = b_0 + k$

For n dimension equations k is use before the use of Matrix

for k = 2.

w = 6
z = 6
x = -5
y = 3

$2x + 2y + z + w - 8 = 0$

(2, 2, 2, 2)

(1, 2, 3, 1).

$X_1 = \frac{2(-8+2)+0+2}{2}$

$X_1 = \frac{-12+2}{2}$ $X_1 = \frac{-10}{2}$

$\boxed{X_1 = -5}$

$k = \frac{6+16-0}{3}$

$\boxed{k = \frac{22}{3}}$

2

$2(3) + 2(1) +$
$6 + 3 + 1 - 2 - 8 = 0$

$x = 3,\ y = 1,\ z = 1,\ w = -2$

$k_x = ?$
$k_w = ?$

$\frac{w}{1} \times \frac{a_0 + k}{-a_w}$

$k_w = -a_w w - a_0$

$k = +2 + 8$ $\boxed{k_w = 10}$.

$k_z = -a_z z - a_0$

$k_z = -2 + 8 \Rightarrow \boxed{k_z = 6}$.

$k_y = -a_y y - a_0$

$k_y = -2 + 8 \Rightarrow \boxed{k_y = 6}$

$k_x = ?$ $X = \frac{Ca_0 + Ck + b_0 + k}{a_1}$

$Ca_0 + b_0 + Ck + k = a_1 x$.

$k(C+1) = a_1 x - (a_0 - b_0)$

$\boxed{k = \frac{a_1 x - (a_0 - b_0)}{C+1}}$

$\frac{6+16-0}{3} = \boxed{22/3}$

$$X = \frac{c(a_0 + k) + b_0 + k}{a_1}$$

$$X = \frac{2(-8 + k) + 0 + k}{2}$$

$$X = \frac{-16 + 2k + k}{2}$$

$$3k - 16 = 2x$$

$$3k = 2x + 16$$

$$3k = 6 + 16 \qquad \frac{3k}{3} = \frac{22}{3}$$

$$k = 22/3$$

$$X = \frac{2(-8 + 22/3) + 0 + 22/3}{2}$$

$$X = \frac{-16 + \frac{44}{3} + 0 + 22/3}{2}$$

$$X = \frac{-\frac{48 + 44}{3} + 22/3}{2}$$

$$X = \frac{-\frac{48 + 44 + 22}{3}}{2} \qquad X = \frac{-\frac{4 + 22}{3}}{2}$$

$$X = \frac{\frac{18}{3}}{2} \qquad X = \frac{6}{2} \qquad \boxed{X = 3}$$

$x+y=2$

$x+y-2=0$

~~$x+y-6=$~~

$x+y+2=4$

$x+2=4-y$

$$\begin{vmatrix} x & 2 \\ -y & 4 \end{vmatrix} = \begin{vmatrix} 6 \\ 6 \end{vmatrix}$$

$x+2=6$

$-y+4=6$

$-y=2$

$\boxed{y=-2}$

$x+2=6$

$x-4=0$

$\boxed{x=4}$

$K(0,0,-4,10)$

$2x+3y+z+w-8=0$

$3 \quad 1 \quad 2 \quad -2 \quad -8=0$

$6+2+2-2-8=0$

$8-0-8=0$

$0=0$

$2x+2y+z+w-8=0$

$w=6,\ z=6,\ x=-5,\ y=3$

$2(-5)+2(3)+6+6-8=0$

$-10+6+6+6-8=0$

$-4+6+6-8=0$

$2+6-8=0$

$8-8=0$

$0=0$

$k=\dfrac{a_1x_1-ca_0-b_0}{1+c}$

$k=\dfrac{2(-5)-2(-8)-0}{1+2}=\dfrac{-10+16}{3}=\dfrac{6}{3}$

$\boxed{k=2}$

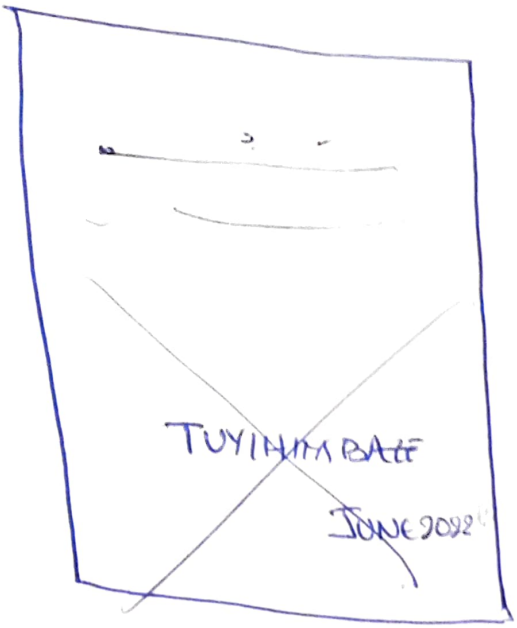
$k=-a_nx_n-a_0$

$k_w=-1(6)-(-8)$

$k_w=-6+8 \mid k_w=2$

$k_y=-2(3)-(-8)$

$k_y=-6+8$ (2)

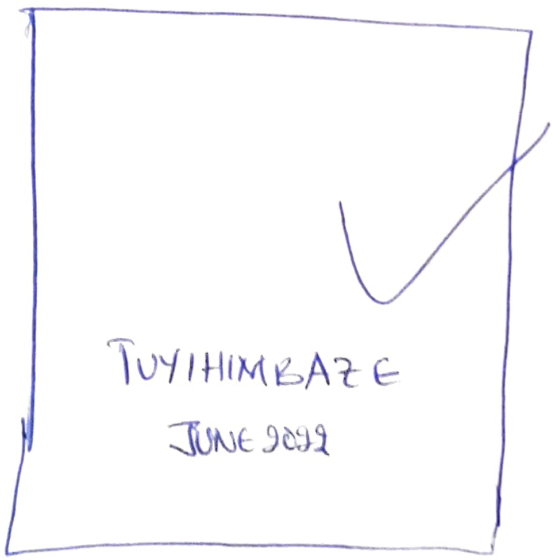


$$X = \frac{c(a_0+k)+b_0+k}{a_1}$$

$$X = \frac{2(-8)+0+0}{2}$$

$$X = \frac{-16}{2} = -8$$

$$X = \frac{c(a_0+k)+b_0+k}{1+c}$$



$$k = \frac{a_1 x_1 + c a_0 + b_0}{1+c}$$

$$k = 2$$

$$X = \frac{2(-8)+0+2}{1}$$

$$X = -16+2 \quad X = -14$$

$$y = \frac{a_0+k}{-a_y}$$

$$y = \frac{-2+4}{1} \quad y = 2$$

$$k = -a_y y - a_0$$

$$k = 12+2$$

$$k = 14$$

$$x+y-2=0$$

$$y = -12$$

$k_w = 10, \quad k_z = 6, \quad x_y = 6 \quad k_x = 22/3$

$$w = \frac{+a_0 + k}{-a_w} = \frac{-8+10}{-1} = -2$$

$$z = \frac{a_0 + k}{-a_z} = \frac{-8+6}{-1} = 2$$

$$y = \frac{a_0 + k}{-a_y} = \frac{-8+6}{-2} = 1$$

$$x = \frac{c(a_0 + k) + b_0 + k}{a_x} = \frac{2(-8 + 22/3) + 22/3}{2}$$

$$x = \frac{-16 + \frac{44}{3} + \frac{22}{3}}{2} = \frac{\frac{-48+44}{3} + \frac{22}{3}}{2}$$

$$x = \frac{\frac{-4+22}{3}}{2} = \frac{\frac{18}{3}}{2} = \frac{6}{2} = 3$$

$x^2 = 2$

$x = \sqrt{2}$

$x^2 + y^2 + z^2 = 4$

$\sqrt{2} + \sqrt{2} + 0 = 0$

$$k_1 = \frac{1(2) - (-4) - 0}{2} = \frac{2+4}{2} = 3$$

$$k_2 = -(1 * 2) - (-4) = -2 + 4 = 2$$

$$k_3 = -(1 * 0) - (-4) = 4$$

$$z = \sqrt{\frac{-4+4}{1}}$$

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

$$\boxed{z = 0}$$

$$y = \sqrt{\frac{-4+2}{-1}} = \sqrt{2}$$

$x_1 + x_2 + x_3 = 4$

$x_1 = 4$

$x_1 + x_2 + x_3 + a_0 + (n-1)(100) = b_0$

$x_1 + x_2 + x_3 + a_0 = 4$

$4 + 4 = 4 + 8$

$x_1 = 4 - 8$

$x_1 = -4$

$x_1 + x_2 + x_3 + a_0 + (n-1)b_0 = b_0 + (n-2)a_0$

$x_1 + x_2 + x_3 + a_0 = b_0 + b_0(n-1) + a_0(n-2)$

$x_1 = b_0 - b_0(n-1) + a_0(n-2)$

$= b_0(1 + (n-1)) + a_0(n-2)$

$= b_0(1 + n - 1) + a_0(n-2)$

$= b_0(n) + a_0(n-2)$

$x_1 = b_0(n) + a_0(n-2)$

$x_3 + a_0 = b_0 \quad x_3 = b_0 - a_0$

$x = \frac{4(3) + 0}{2}$

$x = 6$

$12 =$

$x_1 + x_2 = 2$

$x_1 = 0 + 0 \quad x_1 = 0$

$x_2 = 2 - 0 \quad x_2 = 2$

$2x_1 + x_2 + x_3 = 4$

$x_1 = \frac{4(2-3) + 0}{2}$

$x_1 = \frac{-4}{2} \quad x_1 = -2$

$x_2 = 4 - 0 \quad x_2 = 4$

$x_3 = 4$

$2(-2) + 4 + 4 = 4$

$-4 + 4 + 4 = 4$

$4 = 4$

$$a_1 x_1^{p_1} + a_2 x_2^{p_2} + \dots + a_n x_n^{p_n} + a_0 + k = b_0 + k$$

$+(a_0+k) = 0$ $\quad (a_0+k) = 0 \dots$ $\quad 0$

$$a_1 x_1^{p_1} + a_2 x_2^{p_2} + \dots + a_{n-1} x_{n-1}^{p_{n-1}} + a_n x_n^{p_n} + a_0 + k = b_0 + k$$

$+(a_0+k) = 0$ $\quad +(a_0+k) = 0$ $\quad = 0$ $\quad +(n-2)(a_0+k)$

$$a_n x_n^{p_n} + a_0 + k = 0$$

$$x_n^{p_n} = -\frac{a_0+k}{a_n}$$

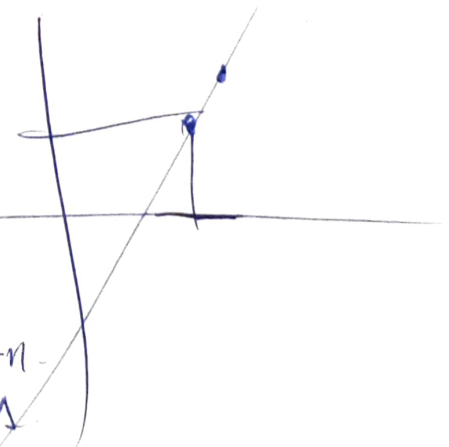
$$\boxed{x_n = \sqrt[p_n]{\frac{a_0+k}{a_n}}}$$

$$a_1 x_1^{p_1} = b_0 + k + (n-2)(a_0+k)$$

$$x_1^{p_1} = \frac{b_0 + k(n-1) + a_0(n-2)}{a_1}$$

$$\boxed{x_1 = \sqrt[p_1]{\frac{b_0 + k(n-1) + a_0(n-2)}{a_1}}}$$

$$\left\{ \begin{array}{l} x_1 + x_2 + x_3 = 3 \\ 1 \quad 3 \quad 3 \\ 3-6 \end{array} \right\}$$



$$S = 1 + 2 + 3 + \dots + n-1 + n$$
$$n + n-1 + \dots + 3 + 2 + 1$$

$x_1 + \underbrace{x_2}_{0} + \underbrace{x_3}_{0} + \cdots + \underbrace{x_n}_{0} + a_0 = 0.$

$x_1 = 0$

$x_1 + x_2 + x_3 + \cdots + x_n + a_0 = b_0$

~~$x_1 + x_2 + a_0$~~ $x_1 + x_2 + a_0 = 0$

$x_1 + x_2 + 2 = 4$. Thus some as $x_1 + x_2 = 2$.

$x_1 = \frac{4}{1}$ $x_1 = 4$

$x_2 = \frac{2}{1}$ $x_2 = 2$

$x_1 = \frac{2}{1}$ $x_1 = 2$

$x_2 = \frac{0}{-1}$ $x_2 = 0$

$x + y = 4.$

$x = \frac{4}{1}$ $x = 4$

$y = \frac{0}{1}$ $y = 0$

$2x + y + z = 6$

$z = \frac{0}{1}$ $z = 0$ $y = 0$

$x = \frac{6}{2}$ $x = 3$

$2x + y + z + 2 = 8$

$z = 2$ $y = 2$

$x = 4$

$8 + 2 + 2 + 2 = 8$

$$a_1 x_1^{p_1} + a_2 x_2^{p_2} + \cdots + a_{n-1} x_{n-1}^{p_{n-1}} = 0$$

$$a_1 x_1^{p_1} + a_2 x_2^{p_2} + \cdots + a_{n-1} x_{n-1}^{p_{n-1}} + 0 = 0$$

$$\cancel{0 = a_0}$$

$$a_1 x_1^{p_1} + a_2 x_2^{p_2} + \cdots + a_{n-1} x_{n-1}^{p_{n-1}} + a_0 = 0 + a_0$$

Lastly $a_1 x_1^{p_1} = 0$

$$a_1 x_1^{p_1} + 0 = 0$$

$$a_1 x_1^{p_1} + a_0 = 0$$

$$a_1 x_1^{p_1} + a_2 x_2^{p_2} + \cdots + a_{n-2} x_{n-2}^{p_{n-2}} + a_0 = a_0 + a_0$$

$$a_1 x_1^{p_1} + a_2 x_2^{p_2} + \cdots + a_{n-3} x_{n-3}^{p_{n-3}} + a_0 = 2a_0 + a_0$$

$\cancel{a_1 x_1^{p_1} +}$ for $\cancel{\frac{n-2}{2} = \frac{2a_0}{2}}$ $a_0 =$

$$a_1 x_1^{p_1} + a_2 x_2^{p_2} + \cdots + a_{n-3} x_{n-3}^{p_{n-3}} + a_0 = 3a_0 + b_0$$

$$c = n - 2$$

$a_1 x_1^{p_1} = 3a_0$, since $n = 5$; then $c = n - 2$.

$$\frac{a_1 x_1^{p_1}}{a_1} = \frac{c a_0}{a_1} \qquad \boxed{x_1^{p_1} = \frac{c a_0 + b_0}{a_1}} \qquad \boxed{x_1^{p_1} = \frac{c a_0 + b_0}{a_1}}$$

k is added to find more points or a target point.

$$a_1 X_1^{p} + a_2 X_2^{p} + \cdots + a_{n-1} X_{n-1}^{p} + a_n X_n^{p} + a_0 + k = 0$$

$$\underbrace{a_1 X_1^{p} + a_0 + k}_{n=1} + \underbrace{a_2 X_2^{p} + a_0 + k}_{n=2} + \cdots + \underbrace{a_{n-1} X_{n-1}^{p} + a_0 + k}_{n=n-1} + \underbrace{a_n X_n^{p} + a_0 + k}_{n=n} = 0$$

$$a_1 X_n^{p} + a_0 + k + \cdots + a_n X_n^{p} + a_0 + k = (a_0 + k)(n-1) + k$$

$$a_1 X_n^{p} + a_0 + k + \cdots + a_n X_n^{p} + a_0 + k = a_0 n - a_0 + kn - k + k$$

$$= a_0 (n-1) + kn.$$

$$a_1 X_n^{p} + a_0 + k = a_0 (n-1) + kn.$$

$$\frac{a_1 X_n^{p}}{a_1} = \frac{a_0 (n-1) + k(n-1) - a_0}{a_1}$$

$$X_n = \sqrt{\frac{a_0 (n-1) + k(n-1) - a_0}{a_1}}$$

$$X_n = \sqrt{\frac{a_0 (n-1-1) + k(n-1}{a_1}}$$

$$\boxed{X_n = \sqrt{\frac{a_0 (n-2) + k(n-1)}{a_1}}}$$

$$a_n X_n^{p} + a_0 + k = 0.$$

$$\boxed{X_n^{p} = \sqrt{\frac{a_0 + k}{-a_n}}}$$

RWANDA-KIGALI

EASTERN PROVINCE

NYAGATARE DISTRICT

NYAGATARE SECONDARY SCHOOL

22nd, January, 2013.

THE DIRECTOR GENERAL

FOR SCIENCE, TECHNOLOGY AND

RESEARCH,

P.0 BOX 622,

KIGALI-RWANDA.

Dear Madam,

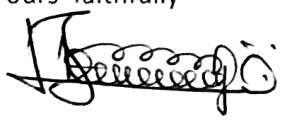
RE: PRESENTATION OF MY INVENTION

I humbly present to you, the formula and theorems I discovered for single equations of more than one unknown, after studying about space geometry in three dimensions, it was confusing to solve those equations, but I became with an idea to form the formula that can simply solve such equations successfully, and I did effectively.

My documents about the formula and my personality descriptions are attached.

I appreciate and wait for your good response

Yours' faithfully



TUYIHIMBAZE Serge.

T.SERGE'S THEOREM AND FORMULAE FOR A SINGLE EQUATION OF TWO OR MORE UNKNOWNS

The 1st T.Serge's theorem states that: the values of two or more unknowns in a single equation could be defined from $]-\infty, +\infty[$ and the interval between the values of the same sign should be constant.

The 2nd T.Serge's theorem states that: the next value **(Nv)** of unknown is directly proportional to the selected real number from $]-\infty, +\infty[$ **(TS)** times constant **(K)** but for multiplied unknowns and powered unknowns the first value remains constant.

$$Nv \propto TS \implies Nv = TS * K$$

T.Serge's Theorem's links

The 1st link states that: the constant **(K)** value is equal to a half of summation of middle value and smallest value where the number of unknowns is even and it is a difference of smallest value and middle value where the number of unknowns is odd.

Formula where the number of unknowns is even	Formula where the number of unknowns is odd
$K = \frac{M + S}{2}$	$K = \frac{S - M}{2}$

The 2nd link states that: the selected real number (TS) goes with the sign of the value of unknown that is used and that value must be added to the product of selected real number **(TS)** and constant **(K)**

$$TS = (\pm)(]-\infty, +\infty[) \implies Nv = (\pm)TS * K + V$$

The overall formulae where:

(i) To find the first value of unknowns :

Consider that: the integers are a and b, then the unknowns are X and Y

E.g.: $X + a = Y - b$

TSF	a	-b	a+(-b)	
X	X+a	-b-X	Answer 1	Answer 2
Y	a-Y	Y-b	Answer 2	Answer 1

- ✓ **The next step is to equate each shaded equation with the summation of integers**
- ✓ **The results to get are :**
  1. **X_1=Answer 1**
  2. **X_2=Answer 2**
  3. **Y_1=Answer 2**
  4. **Y_2=Answer1**

N.B: The rules followed in cells of answers, is to use the value of X from column of integer a, and that of Y in column of integer –b, or X value from –b and Y value from a, in order to equate the equation.

(ii) To find next value : $Nv = (\pm)TS * K + V$

SIMPLE EXAMPLES

Single Equation of two unknowns

1. $2X + 20 = 40 - Y$
2. $6X - 18 = 24 + 3Y$
3. $4X + 14 = 2Y - 28$
4. $2X + 16 - 3Y = 28 - 6X + 2Y$

Single Equation of three unknowns

5. $2X + 12 - Z = 3Y + 8 + Z$
6. $6Y + 2X + 18 = 4Z + 16$

Single Equation of four unknowns

7. $2X + 14 - 8Y = 4Z + 18 + 6Q$
8. $2X + 16 - 3Z = 28 - 6T + 2Q$

Single Equation of powered unknowns

9. $X^2 + 2X + 12 - 3Y = 7Y + 24 - Y^2$
10. $X^2 - 15X - 6 = -Y^2 + Y - 56$
11. $\frac{\sqrt{X+2}}{Y^2+6Y+8} = \frac{3}{(x+2)^{3/2}}$

Single Equation of multiplied unknowns

12. $4P^2 + 8XP + 6P = 2\pi$
13. $Y(z+1/x) = 1/x(12-z)-1$
14. $X+Y+Z+XYZ = 12$
15. $(X+1)^2+(Y+2)^2+(Z-4)^2 = 5$

WRITE BELOW YOUR OBSERVATIONS AND YOUR CONCLUSION ABOUT THE PRESANTATION:

.....

.....

.....

.....

.....

CONCLUSION:

...erge's third theorem's link

...notes that; the unknowns of that are the same must be in the same side. left side or Right side

$$Y\left(z+\frac{1}{x}\right)=\frac{1}{x}(12-z)-1.$$

$$Y\left(z+\frac{1}{x}\right)-\frac{1}{x}(12-z)=-1$$

$$Yz+\frac{Y}{x}-\frac{12+z}{x}=-1.$$

$$Yz+\frac{1}{x}(Y-12+z)=-1.$$

$$\left(\frac{1}{x}(Y-12+z)\right)^{**x}=(-1-Yz)^{*x}$$

$$Y-12+z=-x-xYz.$$

$$\frac{Y-12+z}{(-1-Yz)}=\frac{x(-1-Yz)}{(-1-Yz)}.$$

$$x=\frac{Y-12+z}{-1-Yz}.$$

$$x=Y-12+z*(-1-Yz)^{-1}$$

$$x=Y-12+z*\frac{1}{-1-Yz}$$

TSF	-0	-12	-12
x	x	-12-x	-12
$\frac{Y-12+z}{-1-Yz}$	$0-\frac{Y-12+z}{-1-Yz}$	$\frac{Y-12+z}{-1-Yz}$	Y z 24 0

$$\boxed{x=-12}$$

$$\frac{Y-12+z}{-1-Yz}*\frac{-12}{1}.$$

$$Y-12+z=12+12Yz.$$

$$Y-12Yz+z=12+12.$$

$$Y-12Yz+z=24.$$

$$Y(1-12z)+z=24$$

$$\frac{Y(1-12z)}{1-12z}=\frac{24-z}{1-12z}$$

$$Y=\frac{24-z}{1}*\frac{1}{1-12z}$$

$$Y=24-z*\frac{1}{1-12z}$$

TSF	0	24	24
Y	Y	24-Y	24
$\frac{24-z}{1-12z}$	$0-\frac{24-z}{1-12z}$	$\frac{24-z}{1-12z}$	0

$$\boxed{Y=24}.$$

$$\frac{24-z}{1-12z}*\frac{24}{1}$$

$$24-288z=24-z$$

$$-288z+z=24-24$$

$$\frac{-287z}{-287}=\frac{0}{-287}$$

$$\boxed{z=0}.$$

$Y-12+Z=-X-XYZ$

$X=-12$
$Y=24$
$Z=0$.

---

our first equation was

$$Y\left(z+\frac{1}{X}\right)=\frac{1}{X}(12-z)-1.$$

$$24\left(0+\frac{1}{-12}\right)=\frac{1}{-12}(12-0)-1.$$

$$\frac{24}{-12}=\frac{12}{-12}-1$$

$$-2=-1-1$$

$$\boxed{-2=-2}$$

Conclusion: If you have an equation withe more multiplied unknowns with few Integers you try to get that one Interger ~~but~~ which is not multiplied to unknown and you use it as summation. especially in franction equations

1. To find Next Value on the unknowns which are ~~eq~~ both equal to zero it is Irrigal to T'Serge's theorem.
(Non T. Serge's theorem)

2. To find Next Values for unknowns, ~~You~~ is to take the ~~the~~ Value of Unknown with it's Coefficiency and, to get the ~~Value~~ it's own Value it is after.

eg: of false method,

$$2X+4Y+6=20$$

$X=3$
$Y=2$

$$2(3)+4(2)+6=20$$
$$6+8+6=20$$
$$\boxed{20=20}$$

So Next Value of

$X \Rightarrow NV(x)=2\left(\frac{3+2}{2}\right)+3.$

$\boxed{x=8}$

$Y \Rightarrow NV(Y)=2\left(\frac{3+2}{2}\right)+2.$

$\boxed{Y=7}$

then this is false

the truth $\Rightarrow$ $2X+4Y+6=20-4Y$

$x=3$ $\quad 2X=6$
$Y=2$ $\quad 4Y=8$

$NV(2x)=2\left(\frac{-8+6}{2}\right)+6$ | $NV(4x)=2\left(\frac{-8+6}{2}\right)-8.$

$NV(2x)=-2+6$ | $4X=-2-8$

$\boxed{2X=20}$ $X=4$ | $\boxed{4Y=-10}$

$x+y+z=6$

$xyz=6$.

12.

$x+y+z+xyz=12$

$z+xyz+x+y=12$

$\frac{z(1+xy)}{z}+\frac{x}{z}+\frac{y}{z}=\frac{12}{z}$

$1+xy+\frac{x+y}{z}=\frac{12}{z}$.

$1+xy=\frac{12}{z}-\frac{x+y}{z}$.

$1+xy=\frac{12-x-y}{z}\times z$

$z(1+xy)=12-x-y$.

$\frac{z(1+xy)}{(1+xy)}=\frac{12-x-y}{1+xy}$

$$z=\frac{12-x-y}{1+xy}$$

TSF	0	12	12.
z	z	12−z.	
$\frac{12-x-y}{1+xy}$	$0-\frac{12-x-y}{1+xy}$	$\frac{12-x-y}{1+xy}$	

$$z=12$$

from $\frac{12-x-y}{1+xy}$

$\frac{12-x-y}{1+xy}\times\frac{12}{1}$

$12+12xy=12-x-y$.

$12xy+x=-y$

$\frac{x(12y+1)}{x}=\frac{-y}{x}$

$\frac{12y+1}{y}=x\left(\frac{-1}{x}\right)$

$-\frac{1}{x}=\frac{12y+1}{y}$

$-\frac{1}{x}=\frac{12y}{y}+\frac{1}{y}$

$-\frac{1}{x}=12+\frac{1}{y}$.

TSF	−1	12	11
$\frac{1}{x}$	$-\frac{1}{x}$	$12-\frac{1}{x}$	
$\frac{1}{y}$	$-1-\frac{1}{y}$	$12+\frac{1}{y}$	

$\frac{-1}{x}=11$

$$x=\frac{-1}{11}$$

$12+\frac{1}{y}=11$

$\frac{1}{y}=11-12$

$\frac{1}{y}\times\frac{-1}{1}$

$\frac{-y}{-1}=\frac{1}{-1}$ $\quad y=-1$.

$X+Y+Z=10.91$
$XYZ=1.09$

So $X+Y+Z+XYZ=10.91+1.09$

$X+Y+Z+XYZ=10.91+1.09$

$\boxed{X+Y+Z+XYZ=12}$ ✓

Conclusion: on multiplied unknowns it is not good to use the summation that can cause unknown to get value of zero if there is the other intergers in a fraction equation you can use it them by adding them or substruct them.

$2X+6=20+4Y$
$X=9$ $2X=18=20$
$Y=2$ $4Y=4=6$
$18+6=20+4$
$20+6=20+6$

$20+6=20-22$
$-14+8=-6$

By continuing on Next Values

$2X+4Y+6=20-4Y$
$2X+6=20-4Y$
$NV=(\pm)\,TS\times K+V$
$NV=2X\left(\frac{M+S}{2}\right)+V$
$NV(2X)=?$
$NV(2Y)=?$
$2X=6$
$4Y=8$
$NV(2X)=(\pm)\,\frac{2(8+6)}{2}+6$
$2X=14+6$ $\boxed{2X=20}$

$NV(4Y)=-\frac{2(8+6)}{2}+8$
$NV(4Y)=-1(8+6)+8$
$NV(4Y)=-8-6+8$
$NV(4Y)=-14+8$
$\boxed{4Y=-6}$

$2X+6=20-4Y$
$20+6=20-(-6)$
$26=20+6$
$\boxed{26=26}$

$)^2+(y+2)^2+(z-4)^2=5$

$x^2+2x+1+y^2+4y+4+z^2-8z+16=5$

$x^2+2x+1+y^2+4y+4=5-z^2+8z-16$

$x^2+2x+1+y^2+4y+4=-z^2+8z-11$.

$(x^2+2x+1)+(y^2+4y+4)=(-z^2+8z-11)$.

$x^2+2x+1+y^2+4y+4=-z^2+8z-11$.

TSF	1+4	-11	-6
x^2+2x+y^2+4y	$x^2+2x+y^2+4y+1+4$	$-11-(x^2+2x+y^2+4x)$	
$-z^2+8z$	$5+z^2-8z$	$-z^2+8z+21$	

$5+z^2-8z=-6$

$z^2-8z=-6-5$

$z^2-8z=-11$.

$z^2-8z+11=0$.

$X_{12}=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$

$z_{1,2}=\frac{+8\pm\sqrt{64-4\times1\times11}}{2\times1}$

$z_{1,2}=\frac{8\pm\sqrt{64-44}}{2}$

$z_{1,2}=\frac{8\pm\sqrt{20}}{2}$ $z_1=\frac{8+4.47}{2}$

$z_{1,2}=\frac{8\pm4.47}{2}$ $z_1=\frac{12.47}{2}$ $z_1=6.23$.

$z_1=\frac{12.16}{2}$ $z_1=10.08$

$z_2=\frac{8-4.47}{2}=\frac{+3.6}{2}=1.8$

$z_2=-2.08$ $z_2=1.8$.

from $-11-(x^2+2x+y^2+4x)=-6$

$-(x^2+2x+y^2+4x)=-6+11$

$\frac{-(x^2+2x+y^2+4y)=5}{-1}$

$x^2+2x+y^2+4x=-5$

$x^2+2x+y^2+4x+5=0$.

$x^2+2x+y^2+4x+1+4=0$.

$(x^2+2x+1)+(y^2+4x+4)=0$

$(x^2+2x+1)=0$ - - (i)

$(y^2+4x+4)=0$ - - (ii)

from (i)

$(x^2+2x+1)=0$.

$p=1$, $s=2$? $(1;1)$

$(x^2+x)+(x+1)=0$

$x(x+1)+1(x+1)=0$

$(x_1+1)(x+1)=0$.

$x_1=-1$

$x_2=-1$

from (ii) $(y^2+4x+4)=0$.

$y^2+4y+4=0$

$p=4$, $s=4$ $\}(2;2)$

$(y^2+2y)+(2y+4)=0$

$y(y+2)+2(y+2)=0$

$(y+2)(y+2)=0$.

$y_1=-2$

$y_2=-2$

All Answers

$z_1=$ 6.2 $\quad z_2=+$ 1.8

$x_1=-1 \quad x_2=-1$

$y_1=-2 \quad y_2=-2$

The equation solved

$(x+1)^2+(y+2)^2+(z-4)^2=5$

$(-1+1)^2+(-2+2)^2+(8.6-4)^2=5$.

$\Rightarrow 0+0+$

or $(-1+1)^2+(-2+2)^2+(-0.6-4)^2=5$.

$(x+1)^2+(y+2)^2+(z-4)^2=5$.

$(-1+1)^2+(-2+2)^2+(6.2-4)^2=5$ 1.76

$0+0+(2.236067)^2=5$ ✓

$0+0+(1.8-4)^2$ -2.236 ✓

PAUL A FOERSTER.

—ALGEBRA TRIGONOMETRY.—

LINEAR EQUATIONS WITH THREE OR MORE VARIABLES.

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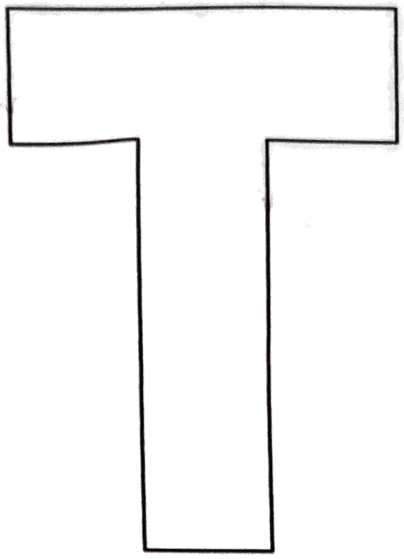

T.SERGE ALGORITHM FOR LINEAR EQUATION IN N VARIABLES.

"Do not worry about your difficulties in Mathematics. I can assure you mine are still greater.
Professor Albert Einstein."

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T.SERGE'S ALGORITHM AND FORMULAS

Linear equations of n variables

A Linear equation in n unknowns $x_1, x_2, x_3, \ldots, x_n$ has the following form:

$$a_1x_1 + a_2x_2 + a_3x_3 + \cdots a_nx_n + a_o = 0$$

Where;

$a_1, a_2, \ldots, b_1, b_2$ are Coeficients of given variables

$x_1, x_2, \ldots, x_{n+m}$ are Variables

a_o and b_o are Given Constants from real number ($\mathbb{R}$)

k Is a real number ($\mathbb{R}$) that can be added to an equation in order to direct all the coordinates to a certain point in the n space which is known as a hyperplane.

The variables can also be written as x, y, z, etc. Linear equations involve only variables of degree 1 (no exponents or roots of the variables), and they involve only sums and constant multiples of variables, without any products of variables.

Example of Linear Equations:

$$2x_1 + 4x_2 + x_3 = 12$$

$$\pi x + 2y = 90$$

But the following equations are not Linear:

$$xy + z = 18$$

$$x^2 + z = 6$$

Linear equation's solution is a vector composed of values $[s_1, \ldots, s_n]$, where when we can substitute $x_1 = s_1, \ldots, x_n = s_n$ to obtain a correct equation. An equation in one variable (example, 2x = 6) has only one solution (a point on the real number line, in this case x = 6). A linear equation in two variables has solutions which geometrically form a line in the plane. A linear equation in three variables has solutions which form a plane. For linear equations of more variables, the geometric interpretations aren't as clear, but they still have an infinite set of solutions.

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Methods of solving Linear equations

When presented with linear equations, we are almost always interested but also confused in solving such equations. Here, various methods of solving these equations are looked at, what is important to remember is that a better algorithm to solve equations should be efficient and not time consuming

Table method (Assumption method)

Table method was the simplest method of finding the solution to the linear equation of n variables, and was also the latest step in the more powerful methods of solving linear equations. This method involves isolating a single variable to express one variable in terms of another and substituting other remaining valuables by any chosen real number ($\mathbb{R}$) and continuing until we have solved for all variables. We have to remember that we may get infinity solutions and different solutions are obtained depending on the chosen real number to substitute remaining variables.

Example1: To solve a linear equation using;

Table method (Isolation)	T.Serge Formulas
$5x + 4y - 2z + 8 = 12$ $5x = 12 - 8 + 2z - 4y$ $x = \frac{4 + 2z - 4y}{5}$ *Let* $y = -2$ *and* $z = 4$, $x = \frac{4 + 2(4) - 4(-2)}{5}$ $x = \frac{20}{5} = 4$ $\underline{x, y, z = \{4, -2, 4\}}$ A table can be used to find more solutions:	$\Rightarrow \quad 5x + 4y + 8 = 12 + 2z$ $x = \frac{a_i + b_o}{a_1} = \frac{8 + 12}{5} = \mathbf{4}$ $y = \frac{a_i}{-a_2} = \frac{8}{-4} = \mathbf{-2}$ $z = \frac{a_o}{b_1} = \frac{8}{2} = \mathbf{4}$ $\underline{x, y, z = \{4, -2, 4\}}$ We add any $\boldsymbol{k}$ value to the constants in both sides to find more solutions.

x			4
y	-4	-3	-2
z	8	6	4

We substitute y and z by real numbers and put them in $x = \frac{4+2z-4y}{5}$ to find the values of x.

With this formula, the values of x depend on what you choose to be y and z. different people can get the same point but this has a lower probability. It means that everyone can get different answers which challenge instructors to prove whether all given solutions are collect. To be able to prove whether the coordinates given are true, all given solutions should be plotted on the graph so that a shape represented can prove easily that points obtained are correct.

The T.Serge Algorithm and formulas to solve linear equation with n variables

As shown above, we were able to solve a linear equation with n variables, and we know that different people can get one solution but have different coordinates and the solution obtained in approximately 40 Seconds Minimum.

With T.Serge Algorithm we are going to see how we can efficiently solve linear equations in shorter time and prove that different people can solve it and get one solution and same coordinates.

Given that we have the following linear equation

$$\boldsymbol{a_1x_1 + a_2x_2 + a_3x_3 + \cdots a_nx_n + a_o = 0}$$

$$\sum_{k=0}^{n} a_k x_k + a_0 = 0$$

It represents an n-1 dimensional object in n-space called a **hyperplane.**

Translation of Linear equation form to use T.Serge Algorithm,

$$\sum_{k=0}^{n} a_k x_k + a_0 = \sum_{i=0}^{m} b_i x_{n+i} + b_0$$

i. If an equation has even number of variables, both left and right hand side will have equal number of variables. i.e.: $x_1 + x_2 + \cdots + x_{(n/2)} = x_{\left(\frac{n}{2}\right)+1} + x_{\left(\frac{n}{2}\right)+2} + \cdots + x_n$

ii. Else if the number of variables is odd, the left hand side will have one more variable than the right hand side. i.e.: $x_1 + x_2 + \cdots + x_{\left(\frac{n}{2}\right)+1} = x_{\left(\frac{n}{2}\right)+2} + x_{\left(\frac{n}{2}\right)+3} + \cdots + x_n$

N.B: The values of variables depend on the side where they are placed in the equation either left hand side (LHS) or right hand side (RHS). To avoid the confusion, the order to follow should be determined whether alphabetic order like (x, y, z) or numbering from$(x_1, x_2, \ldots, x_n)$ according to the given variable.

Definition: A linear equation is homogeneous if it has a constant of zero, so that it can be written as $\boldsymbol{a_1x_1 + a_2x_2 + a_3x_3 + \cdots a_nx_n = 0}$

iii. If we are given a homogeneous linear equation and need non-zero values in our variables, we should add a constant $\boldsymbol{k}$, a real number ($\mathbb{R}$), in both sides, that constant is noted as $\boldsymbol{a_o}$ in the left and $\boldsymbol{b_o}$ in the right hand side. **(It is recommended that** if the value of $\boldsymbol{k}$ was not given and when it is required to use it to avoid zero values, assign to it the product of coefficients of all variables in equation and add that to both side as well as $\boldsymbol{a_o}$ and $\boldsymbol{b_o}$. and these real numbers help us to direct our solution (Coordinates) to a certain point in hyperplane. So, if we need to change these constant values $\boldsymbol{a_o}$ and $\boldsymbol{b_o}$ we add a constant value $\boldsymbol{k}$ to both sides, and this is chosen from real number ($\mathbb{R}$).

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The T.Serge Algorithm (Pseudocode)

The following algorithm, includes step by step equation transformation like arranging constants and variables on rows and columns just as a matrix, and sums the rows to equate them to the total sum of constants in the equation to get solution as $x_1 = s_1, \ldots, x_n = s_n$

We have this linear equation: $a_1x_1 + a_2x_2 + a_3x_3 + \cdots a_nx_n + a_o = 0$

Step 1:

i. If an equation has even number of variables, both left and right hand side will have equal number of variables. i.e.: $x_1 + x_2 + \cdots + x_{(n/2)} = x_{\left(\frac{n}{2}\right)+1} + x_{\left(\frac{n}{2}\right)+2} + \cdots + x_n$

ii. Else if the number of variables is odd, the left hand side will have one more variable than the right hand side. i.e.: $x_1 + x_2 + \cdots + x_{\left(\frac{n}{2}\right)+1} = x_{\left(\frac{n}{2}\right)+2} + x_{\left(\frac{n}{2}\right)+3} + \cdots + x_n$

iii. When the given linear equation has a_o or/and b_o each must remain in its/their side(s) as was given, they must not be displaced/moved to the other side accept when it is instructed.

This is a general equation:

$$a_1x_1 + a_2x_2 + a_3x_3 + \cdots a_nx_n + a_o = b_1x_{n+1} + b_2x_{n+2} + b_3x_{n+3} + \cdots b_mx_{n+m} + b_o \quad (1)$$

Step 2:

i. On the (2xn) matrix block put the left hand side variables and their coefficients on the row**1** and each on its column from **1** up to column **n** and those from the right hand side you put them on the row**2** and column**1** to n

ii. Put the constant a_o on a new block of (2x1) matrix at row**1** and column**1** and b_o on row**2**, column**1**. **Add** the constants a_o and b_o and put their summation in the right hand side in a block of (2x1) matrix on the row**1**, column**1** and put the same on row**2** and column**1**.

It will look like:

$$\begin{vmatrix} a_1x_1 & a_2x_2 & a_3x_3 & \ldots & a_nx_n \\ b_1x_{n+1} & b_2x_{n+2} & b_3x_{n+3} & \ldots & b_mx_{n+m} \end{vmatrix} \begin{vmatrix} a_o \\ b_o \end{vmatrix} = \begin{vmatrix} a_o + b_o \\ a_o + b_o \end{vmatrix}$$

iii. We sum all the variables and their coefficients to the constants a_o or b_o according to the row position and assign them to the sum of those constants $(a_o + b_o)$. those will be named equation1 to n.

We will have:

$$a_1x_1 + a_2x_2 + a_3x_3 + \cdots a_nx_n + a_o = a_o + b_o \ldots\ldots\ldots\ldots (eqn1) \quad (2)$$

$$b_1x_{n+1} + b_2x_{n+2} + b_3x_{n+3} + \cdots b_mx_{n+m} + b_o = a_o + b_o \ldots\ldots\ldots\ldots (eqn2) \quad (3)$$

Step3: If one of the equations obtained from step2 has one variable, calculate its final value. Else if any of the equations obtained from step2 have more than one variable **go to step1**

End.

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The T.Serge Algorithm Output

When the algorithm ends, the values of $x_1 = s_1, \ldots, x_n = s_n$ of a given equation of n dimension will become as shown in the following table.

Variables / Dimensions	Solutions set $(x_1 = s_1, \ldots, x_n = s_n)$			
	x_1	x_2	x_3	x_4
2-D	$\frac{b_o}{a_1}$	$\frac{a_o}{b_1}$		
3-D	$\frac{a_o + b_o}{a_1}$	$\frac{a_o}{-a_2}$	$\frac{a_o}{b_1}$	
4-D	$\frac{a_o + b_o}{a_1}$	$\frac{a_o}{-a_2}$	$\frac{a_o + b_o}{b_1}$	$\frac{b_o}{-b_2}$
	x_1 and x_2 are the same on 3-D and 4-D			

When k value is given to direct coordinates to a certain point, short formulas will change a_o and b_o to become the given constants: a_i, b_i, b_j, b_k at 4D and at 3D only a_o will be changed.

Variables / Dimensions	Solutions set $(x_1 = s_1, \ldots, x_n = s_n)$			
	x_1	x_2	x_3	x_4
2-D	$\frac{b_o}{a_1}$	$\frac{a_o}{b_1}$		
3-D	$\frac{a_i + b_o}{a_1}$	$\frac{a_i}{-a_2}$	$\frac{a_o}{b_1}$	
4-D	$\frac{a_i + b_i}{a_1}$	$\frac{a_i}{-a_2}$	$\frac{a_i + b_j}{b_1}$	$\frac{b_k}{-b_2}$
	x_1 and x_2 are the same on 3-D and 4-D			

Where a_i, b_i, b_j, b_k Stands for the given real numbers that will be used to find a certain point in the n space.

The above general solutions can be used as short formulas to find the values of given variable in a linear equation.

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How to find a_i, b_i, b_j or b_k:

Variables / Dimensions	Solutions set $(x_1 = s_1, \dots, x_n = s_n)$			
	x_1	x_2	x_3	x_4
2-D	$\frac{b_o}{a_1}$	$\frac{a_o}{b_1}$		
3-D	$x_1 = \frac{a_i + b_o}{a_1}$ $b_o = a_1x_1 - a_i$	$x_2 = \frac{a_i}{-a_2}$ $a_i = -a_2x_2$	$x_3 = \frac{a_o}{b_1}$ $a_o = b_1x_3$	
4-D	$x_1 = \frac{a_i + b_i}{a_1}$ $b_i = a_1x_1 - a_i$	$x_2 = \frac{a_i}{-a_2}$ $a_i = -a_2x_2$	$x_3 = \frac{a_i + b_j}{b_1}$ $b_j = b_1x_3 - a_i$	$x_4 = \frac{b_k}{-b_2}$ $b_k = -b_2x_4$
On 2D only k value is used.				

Example2: Solving a linear equation using T.Serge Algorithm.

1. $2x + 20 + y = 40$
2. In Euclidian space $\mathbb{R}^3$, the sphere with $M(2,-1,3)$ as center passes through the point $T(1,2,-3)$. Write the equation of the sphere and parametric equations of a line which is tangent through T.
   Source: N° 16 from senior six national exam 2012, Mathematics exam.
3. $2x + 16 - 8y + 6w + 4z = 20$

Answers1:

Start T.Serge Algorithm:

Step1:

$$\rightarrow \mathbf{2x + 20 = 40 - y}$$

Step2:

$$\begin{vmatrix} a_1x_1 \\ b_1x_2 \end{vmatrix} \begin{vmatrix} a_o \\ b_o \end{vmatrix} = \begin{vmatrix} a_o + b_o \\ a_o + b_o \end{vmatrix}$$

$$\begin{vmatrix} 2x \\ -y \end{vmatrix} \begin{vmatrix} 20 \\ 40 \end{vmatrix} = \begin{vmatrix} 60 \\ 60 \end{vmatrix}$$

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$$a_1x_1 + a_o = a_o + b_o \ \ldots\ldots\ldots\ldots (eqn1)$$
$$b_1x_2 + b_o = a_o + b_o \ \ldots\ldots\ldots\ldots (eqn2)$$
$$2x + 20 = 60 \ \ldots\ldots\ldots\ldots (eqn1)$$
$$-y + 40 = 60 \ \ldots\ldots\ldots\ldots (eqn2)$$

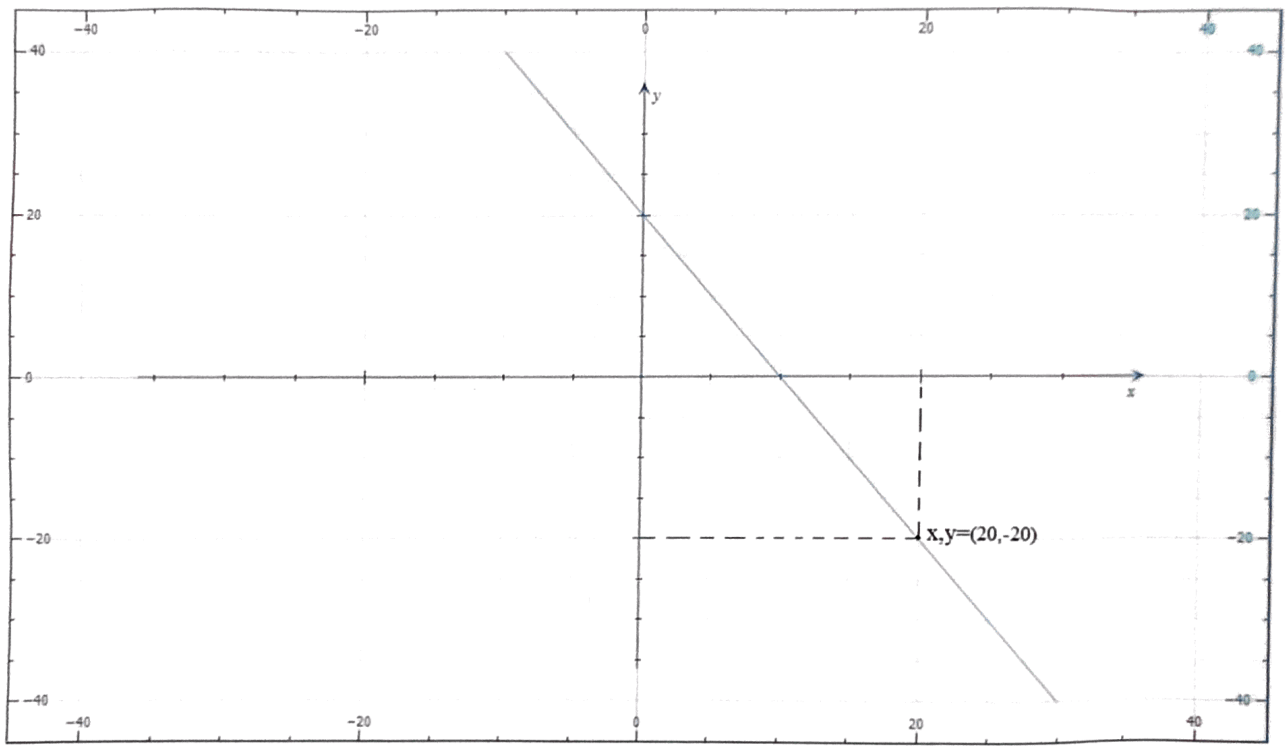
Step3: If equation1 $(eqn1)$ has only one variable, we calculate its value:

$$x_1 = \frac{b_o}{a_1} \rightarrow x_1 = \frac{40}{2} = 20, \quad x_1 = 20$$

Else if equation2 $(eqn2)$ has only one variable, we calculate its value:

$$x_2 = \frac{a_o}{b_1} \rightarrow x_2 = \frac{20}{-1} = -20, \quad x_2 = -20$$

$$\boldsymbol{x_1, x_2} = \{20, -20\}$$



Answers2:

In Euclidian space$\mathbb{R}^3$, the sphere with $M(2,-1,3)$ as center passes through the point $T(1,2,-3)$. Write the equation of the sphere and parametric equations of a line which is tangent through T.

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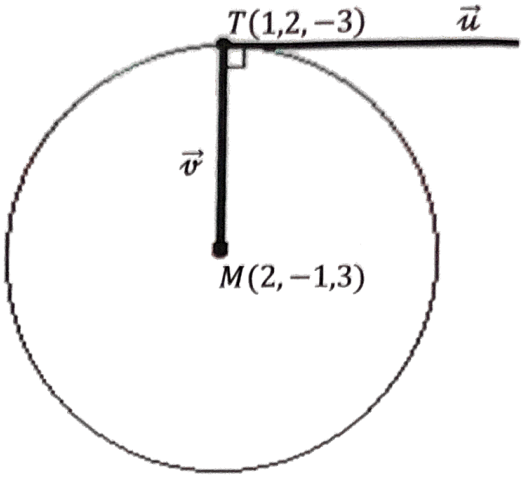
Data given



Equation of sphere is obtained from:

$$(x-a)^2+(y-b)^2+(z-c)^2=R^2$$

To find the radius: $R^2=(x_o-a)^2+(y_o-b)^2+(z_o-c)^2$

$$R^2=-1^2+3^2+6^2$$

$$R^2=46$$

Here we can find our sphere's equation:

$$(x-2)^2+(y+1)^2+(z-3)^2=46$$

$$x^2-4x+4+y^2+2y+1+z^2-6z+9=46$$

$$S\equiv x^2+y^2+z^2-4x+2y-6z-32=0$$

To find the value of:

The vector $\vec{v}$=?

$$\vec{v}=\overrightarrow{MT}=T-M$$

$$\vec{v}=\begin{pmatrix}1\\2\\-3\end{pmatrix}-\begin{pmatrix}2\\-1\\3\end{pmatrix}\Rightarrow\quad \vec{v}=(-1,3,-6)$$

From law of perpendicularity

$$\vec{v}\,.\,\vec{u}=0\Rightarrow\quad \text{Let } \vec{u}=(u_1,u_2,u_3)$$

$$\vec{v}\,.\,\vec{u}\equiv\begin{pmatrix}-1\\3\\-6\end{pmatrix}.\begin{pmatrix}u_1\\u_2\\u_3\end{pmatrix}=0$$

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$$\vec{v}\,.\vec{u} \equiv -u_1 + 3u_2 - 6u_3 = 0$$

Let us find the values of u_1, u_2, u_3, Using T.Serge Algorithm.

We have the following single equation

$$-u_1 + 3u_2 - 6u_3 = 0$$

From T.Serge's theorem, When the value of ***k*** was not given we add the product of coefficients in both sides in order to avoid zero values.

$$3 * 1 * 6 = 18$$

$$-u_1 + 3u_2 - 6u_3 + 18 = 18$$

Start T.Serge Algorithm:

Step1:

$$-u_1 + 3u_2 - 6u_3 + 18 = 18 \quad \rightarrow \quad \mathbf{-u_1 + 3u_2 + 18 = 18 - 6u_3}$$

Step2:

$$\begin{vmatrix} a_1x_1 + a_2x_2 \\ b_1x_2 + b_2x_3 \end{vmatrix} \begin{vmatrix} a_o \\ b_o \end{vmatrix} = \begin{vmatrix} a_o + b_o \\ a_o + b_o \end{vmatrix}$$

$$\left|\begin{vmatrix} -u_1 & 3u_2 \\ -6u_3 & 0 \end{vmatrix}\right| \begin{vmatrix} 18 \\ 18 \end{vmatrix} = \begin{vmatrix} 36 \\ 36 \end{vmatrix}$$

$$a_1x_1 + a_2x_2 + a_o = a_o + b_o \ \ldots\ldots\ldots\ldots (eqn1)$$

$$b_1x_2 + b_o = a_o + b_o \ \ldots\ldots\ldots\ldots (eqn2)$$

$$\downarrow$$

$$-u_1 + 3u_2 + 18 = 36 \ldots\ldots\ldots\ldots (eqn1)$$

$$-6u_3 + 18 = 36 \ \ldots\ldots\ldots\ldots (eqn2)$$

Step3: If any of the equations1&2 $(eqn1\&eqn2)$ has only one variable, we calculate its value:

$$-6u_3 + 18 = 36 \ \ldots\ldots\ldots\ldots (eqn2)$$

$$x_3 = \frac{a_o}{b_1} \rightarrow u_3 = \frac{18}{-6} = -3,$$

$$\boxed{u_3 = -3}$$

Else if any of them has more than one variable, the condition is:

False: *We start from step 1 to step3.*

We have equation1:

$$-u_1 + 3u_2 + 18 = 36 \ldots\ldots\ldots\ldots (eqn1)$$

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Step1:

$$-u_1 + 3u_2 + 18 = 36 \quad \rightarrow \quad \mathbf{-u_1 + 18 = 36 - 3u_2}$$

Step2:

$$\begin{vmatrix} a_1x_1 \\ b_1x_2 \end{vmatrix} \begin{vmatrix} a_o \\ b_o \end{vmatrix} = \begin{vmatrix} a_o + b_o \\ a_o + b_o \end{vmatrix}$$

$$\begin{vmatrix} -u_1 \\ -3u_2 \end{vmatrix} \begin{vmatrix} 18 \\ 36 \end{vmatrix} = \begin{vmatrix} 54 \\ 54 \end{vmatrix}$$

$$a_1x_1 + a_o = a_o + b_o \ \ldots\ldots\ldots\ldots (eqn1)$$

$$b_1x_2 + b_o = a_o + b_o \ \ldots\ldots\ldots\ldots (eqn2)$$

$$\downarrow$$

$$-u_1 + 18 = 54 \ldots\ldots\ldots\ldots (eqn1)$$

$$-3u_2 + 36 = 54 \ \ldots\ldots\ldots\ldots (eqn2)$$

Step3: If equation1&2 $(eqn1\&eqn2)$each has only one variable, we calculate their values:

$$-3u_2 + 36 = 54 \ \ldots\ldots\ldots\ldots (eqn2)$$

$$x_1 = \frac{a_o}{-a_2} \rightarrow u_2 = \frac{18}{-3} = -6$$

$$\boxed{u_2 = -6}$$

$$-u_1 + 18 = 54 \ldots\ldots\ldots\ldots (eqn1)$$

$$x_1 = \frac{a_o + b_o}{a_1} \rightarrow u_1 = \frac{36}{-1} = -36$$

$$\boxed{u_1 = -36}$$

Our Solution Set will be:

$$\vec{u} \equiv \mathbf{u_1, u_2, u_3} = \{-36, -6, -3\}$$

End.

Continuing to finish the answer to the question,

N.B: The values of vector $\vec{u}$ can be more than one

i.e.: $\overrightarrow{u_1}, \overrightarrow{u_2}, \overrightarrow{u_3}, \ldots \overrightarrow{u_n}$

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From parametric equation of a line,

$$D \equiv \begin{cases} x \\ y = \\ z \end{cases} \begin{pmatrix} x_o \\ y_o \\ z_o \end{pmatrix} + \lambda \begin{pmatrix} u_1 \\ u_2 \\ u_3 \end{pmatrix}$$

$$T = (x_o, y_o, z_o) \Rightarrow T = (1,2,-3)$$

$$\vec{u} = (u_1, u_2, u_3) \Rightarrow \quad \vec{u} = (-36,-6,-3)$$

$$D \equiv \begin{cases} x \\ y = \\ z \end{cases} \begin{pmatrix} 1 \\ 2 \\ -3 \end{pmatrix} + \lambda \begin{pmatrix} -36 \\ -6 \\ -3 \end{pmatrix}$$

$$D \equiv \begin{cases} x = 1 - 36\lambda \\ y = 2 - 6\lambda \\ z = -3 - 3\lambda \end{cases}$$

This is parametric equation of the line which is tangent through T.

Answers3:

$$2x + 16 - 8y + 6w + 4z = 20$$

Start T.Serge Algorithm:

Step1:

$$2x + 16 - 8y + 6w + 4z = 20 \quad \rightarrow \quad 6w + 2x + 16 = 20 + 8y - 4z$$

Step2:

$$\begin{vmatrix} a_1x_1 + a_2x_2 \\ b_1x_2 + b_2x_3 \end{vmatrix} \begin{vmatrix} a_o \\ b_o \end{vmatrix} = \begin{vmatrix} a_o + b_o \\ a_o + b_o \end{vmatrix}$$

$$\begin{vmatrix} 6w & 2x \\ 8y & -4z \end{vmatrix} \begin{vmatrix} 16 \\ 20 \end{vmatrix} = \begin{vmatrix} 36 \\ 36 \end{vmatrix}$$

$$a_1x_1 + a_2x_2 + a_o = a_o + b_o \ \ldots\ldots\ldots\ldots (eqn1)$$

$$b_1x_3 + b_2x_4 + b_o = a_o + b_o \ \ldots\ldots\ldots\ldots (eqn2)$$

$$\downarrow$$

$$6w + 2x + 16 = 36 \ \ldots\ldots\ldots\ldots (eqn1)$$

$$8y - 4z + 20 = 36 \ \ldots\ldots\ldots\ldots (eqn2)$$

Step3: If any of the equations1&2 $(eqn1\&eqn2)$ has only one variable, we calculate its value:

Else if any of them has more than one variable, the condition is:

False: *We start from step 1 to step3.*

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We have equation1&2:

$$6w + 2x + 16 = 36 \ldots\ldots\ldots\ldots (eqn1)$$

And

$$8y - 4z + 20 = 36 \ldots\ldots\ldots\ldots (eqn2)$$

Start with equation1

$$6w + 2x + 16 = 36 \ldots\ldots\ldots\ldots (eqn1)$$

Step1:

$$6w + 2x + 16 = 36 \quad \rightarrow \quad 6w + 16 = 36 - 2x$$

Step2:

$$\begin{vmatrix} a_1x_1 \\ b_1x_2 \end{vmatrix} \begin{vmatrix} a_o \\ b_o \end{vmatrix} = \begin{vmatrix} a_o + b_o \\ a_o + b_o \end{vmatrix}$$

$$\begin{vmatrix} 6w \\ -2x \end{vmatrix} \begin{vmatrix} 16 \\ 36 \end{vmatrix} = \begin{vmatrix} 52 \\ 52 \end{vmatrix}$$

$$a_1x_1 + a_o = a_o + b_o \ldots\ldots\ldots\ldots (eqn1)$$

$$b_1x_3 + b_o = a_o + b_o \ldots\ldots\ldots\ldots (eqn2)$$

$$\downarrow$$

$$6w + 16 = 52 \ldots\ldots\ldots\ldots (eqn3)$$

$$-2x + 36 = 52 \ldots\ldots\ldots\ldots (eqn4)$$

Step3: If any of the equations3&4 ($eqn3$&$eqn4$) has only one variable, we calculate its value:

$$6w + 16 = 52 \ldots\ldots\ldots\ldots (eqn3)$$

$$x_1 = \frac{a_o + b_o}{a_1} \rightarrow \quad w = \frac{36}{6} = 6$$

$$\boxed{w = 6}$$

$$-2x + 36 = 52 \ldots\ldots\ldots\ldots (eqn4)$$

$$x = \frac{a_o}{-a_2} \rightarrow \quad x = \frac{16}{-2} = -8$$

$$\boxed{x = -8}$$

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Next with equation2

$$8y - 4z + 20 = 36 \ \ldots\ldots\ldots\ldots (eqn2)$$

Step1:

$$8y - 4z + 20 = 36 \ \rightarrow \quad 8y + 20 = 36 + 4z$$

Step2:

$$\begin{vmatrix} a_1x_1 \\ b_1x_2 \end{vmatrix} \ \begin{vmatrix} a_o \\ b_o \end{vmatrix} = \begin{vmatrix} a_o + b_o \\ a_o + b_o \end{vmatrix}$$

$$\begin{vmatrix} 8y \\ 4z \end{vmatrix} \ \begin{vmatrix} 20 \\ 36 \end{vmatrix} = \begin{vmatrix} 56 \\ 56 \end{vmatrix}$$

$$a_1x_1 + a_o = a_o + b_o \ \ldots\ldots\ldots\ldots (eqn1)$$

$$b_1x_3 + b_o = a_o + b_o \ \ldots\ldots\ldots\ldots (eqn2)$$

$$\downarrow$$

$$8y + 20 = 56 \ \ldots\ldots\ldots\ldots (eqn5)$$

$$4z + 36 = 56 \ \ldots\ldots\ldots\ldots (eqn6)$$

Step3: If any of the equations5&6 ($eqn5\&eqn6$) has only one variable, we calculate its value:

$$8y + 20 = 56 \ \ldots\ldots\ldots\ldots (eqn5)$$

$$x_1 = \frac{a_o + b_o}{b_1} \rightarrow \quad y = \frac{36}{8} = 4.5$$

$$\boxed{y = 4.5}$$

$$4z + 36 = 56 \ \ldots\ldots\ldots\ldots (eqn6)$$

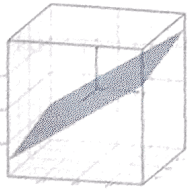
$$x = \frac{b_o}{-b_2} \rightarrow \quad z = \frac{20}{4} = 5$$

$$\boxed{z = 5}$$

Our Solution Set will be:

$$\boldsymbol{w, x, y, z} = \{6, -8, 4.5, 5\}$$

End.



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Here is how to use the value $\boldsymbol{k}$ when it is given

Equations / Dimensions	Solutions set $(x_1 = s_1, \dots, x_n = s_n)$
	$x_1 + 2x_2 = 4$ $x_1 + 2x_2 - x_3 = 8$ $x_1 + 2x_2 - x_3 + x_4 = 6$
2-D Targeted Coordinates $x_1, x_2 = (-2, 2)$	$x_1 + 2x_2 + 2 = 4$ $x_1 + 2 = 4 - 2x_2$ *How to find* $\boldsymbol{k}$*?* If $x_1 = \frac{b_i}{a_1}$ and $x_1 = -2$ *where* $a_1 = 1$ $b_i = a_1 x_1 = -2 * 1$ $b_i = -2$ $k = b_i - b_o$ $k = -2 - 4$ $\boxed{k = -6}$ We add $\boldsymbol{k}$ value to both sides of our equation $x_1 + 2 = 4 - 2x_2$ $x_1 - 4 = -2 - 2x_2$ For $x_1 = \frac{b_o}{a_1}$ $x_1 = \frac{-2}{1} = -2$ $x_1 = -2$ And for $x_2 = \frac{b_o}{a_1}$ $x_2 = \frac{-4}{-2} = 2$ $x_2 = 2$ We have obtained the coordinates needed $x_1, x_2 = (-2, 2)$ by adding the value $k = -6$ to the equation.

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3-D

Targeted Coordinates

$x_1, x_2, x_3 = (6, 2, 2)$

$$x_1 + 2x_2 - x_3 = 8$$

$$x_1 + 2x_2 + 0 = 8 + x_3$$

$$x_1 = \frac{a_i + b_o}{a_1}$$

$b_i = a_1 x_1 - a_i$

$b_i = 6 - a_i$

$b_i = 6 + 4$

$b_i = 10$

$k = b_i - b_o$

$k = 10 - 8$

$k = 2$

$$x_2 = \frac{a_i}{-a_2}$$

$a_i = -a_2 x_2$

$a_i = -2(2)$

$a_i = -4$

$$x_3 = \frac{a_j}{b_1}$$

$a_j = b_1 x_3$

$a_j = 1(2)$

$a_j = 2$

The value of k can also be obtained from

$k = a_j - a_o$

$k = 2 - 0$

$k = 2$

Our equation $x_1 + 2x_2 + 0 = 8 + x_3$ will be $x_1 + 2x_2 + 0 + 2 = 8 + 2 + x_3$

$$x_1 + 2x_2 + 2 = 10 + x_3$$

$$x_1 = \frac{a_i + b_o}{a_1}$$

$$x_1 = \frac{-4 + 10}{1} = 6$$

$$x_2 = \frac{a_i}{-a_2}$$

$$x_2 = \frac{-4}{-2} = 2$$

$$x_3 = \frac{a_o}{b_1}$$

$$x_3 = \frac{2}{1} = 2$$

We have obtained the coordinates needed $x_1, x_2, x_3 = (6, 2, 2)$

By adding the value $k = -6$ to the equation and replacing a_o by a_i

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4-D

Targeted Coordinates

$\boldsymbol{x_1, x_2, x_3, x_4 = (3, 1, 2, 3)}$

$$\boldsymbol{x_1 + 2x_2 - x_3 + x_4 = 6}$$

$$\boldsymbol{x_1 + 2x_2 = 6 + x_3 - x_4}$$

$x_1 = \frac{a_i + b_i}{a_1}$	$x_2 = \frac{a_i}{-a_2}$	$x_3 = \frac{a_i + b_j}{b_1}$	$x_4 = \frac{b_k}{-b_2}$
$\boldsymbol{b_i = a_1 x_1 - a_i}$	$\boldsymbol{a_i = -a_2 x_2}$	$\boldsymbol{b_j = b_1 x_3 - a_i}$	$\boldsymbol{b_k = -b_2 x_4}$
$\boldsymbol{b_i = 3 - a_i}$	$\boldsymbol{a_i = -2(1)}$	$\boldsymbol{b_j = 2 - (-2)}$	$\boldsymbol{b_k = 3}$
$\boldsymbol{b_i = 3 + 2}$	$\boldsymbol{a_i = -2}$	$\boldsymbol{b_j = 4}$	
$\boldsymbol{b_i = 5}$			
$\boldsymbol{k = b_i - b_o}$			
$\boldsymbol{k = 5 - 6}$			
$\boldsymbol{k = -1}$			

4^{Th} Dimension doesn't need the value of $\boldsymbol{k}$ because, we use $\boldsymbol{a_i}$, $\boldsymbol{b_i}$, $\boldsymbol{b_j}$ and $\boldsymbol{b_k}$ Means that the constants $\boldsymbol{a_o}$ and $\boldsymbol{b_o}$ are no longer used at this condition.

Our equation will be $\boldsymbol{x_1 + 2x_2 = 6 + x_3 - x_4}$

$$x_1 = \frac{a_i + b_i}{a_1}$$

$$x_1 = \frac{-2 + 5}{1} = 3$$

$$x_2 = \frac{a_i}{-a_2}$$

$$x_2 = \frac{-2}{-2} = 1$$

$$x_3 = \frac{a_i + b_j}{b_1}$$

$$x_3 = \frac{-2 + 4}{1} = 2$$

$$x_4 = \frac{b_k}{-b_2}$$

$$x_4 = \frac{3}{1} = 3$$

We have obtained the coordinates needed $\boldsymbol{x_1, x_2, x_3, x_4 = (3, 1, 2, 3)}$

By adding the value $\boldsymbol{k = 0}$ to the equation and replacing a_o and b_o by $\boldsymbol{a_i}$, $\boldsymbol{b_i}$, $\boldsymbol{b_j}$ and $\boldsymbol{b_k}$

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Books Checked:

1. Linear Algebra by Jim Hefferon: http://joshua.smcvt.edu/linearalgebra/book.pdf
2. Discrete Mathematics for New Technology, Second Edition by Rowan Garnier and John Taylor, University of Brighton, UK (Chapter 7 Page 325: Systems of Linear Equations): https://books.google.rw/books?id=-LTkWS8QstsC&printsec=frontcover#v=onepage&q&f=false
3. Discrete Mathematics: Proofs, Structures and Applications, Third Edition: https://books.google.rw/books?id=gy7NBQAAQBAJ&pg=PA332&dq=Single+linear+equation+in+n+variables&hl=en&sa=X&ved=0ahUKEwjL7siapIfNAhWlJMAKHSsMDTcQ6AEIQTAG#v=onepage&q=Single%20linear%20equation%20in%20n%20variables&f=false
4. Basic Matrix Algebra with Algorithms and Applications by Robert A. Liebler: https://books.google.rw/books?id=dD1OKMD-rMoC&pg=PA5&dq=Single+linear+equation+in+n+variables&hl=en&sa=X&ved=0ahUKEwjL7siapIfNAhWlJMAKHSsMDTcQ6AEISDAH#v=onepage&q=Single%20linear%20equation%20in%20n%20variables&f=false
5. The VNR Concise Encyclopedia of Mathematics. Editors: W.Gellert S.Gottwald, M. Hellwich H.Kastner H. Kustner: https://books.google.rw/books?id=1jH7CAAAQBAJ&pg=PA357&dq=Single+linear+equation+in+n+variables&hl=en&sa=X&ved=0ahUKEwjL7siapIfNAhWlJMAKHSsMDTcQ6AEITAB#v=onepage&q=Single%20linear%20equation%20in%20n%20variables&f=false
6. Linear Algebra with Applications by Gareth Williams: https://books.google.rw/books?id=1xXTvSfL4DYC&pg=PA3&dq=Gause+about+linear+equations+in+n+variables&hl=en&sa=X&ved=0ahUKEwiDyNn1q4fNAhXjB8AKHXp8DqoQ6AEIGjAA#v=onepage&q=Gause%20about%20linear%20equations%20in%20n%20variables&f=false
7. Elementary Linear Algebra by Stephen Andrilli and David Hecker: https://books.google.rw/books?id=Hg65zoqiUgoC&pg=PA80&dq=Linear+equation+in+n+variables&hl=en&sa=X&ved=0ahUKEwjNqPLRrofNAhWhK8AKHVwCA_wQ6AEIJAC#v=onepage&q=Linear%20equation%20in%20n%20variables&f=false
8. Elementary Linear Algebra, Enhanced Edition By Larson & Falvo: https://books.google.rw/books?id=EGzCCAAAQBAJ&pg=PA2&dq=Linear+equation+in+n+variables&hl=en&sa=X&ved=0ahUKEwjNqPLRrofNAhWhK8AKHVwCA_wQ6AEIOjAF#v=onepage&q=Linear%20equation%20in%20n%20variables&f=false
9. Finite Mathematics for the Managerial, Life, and Social Sciences, Media Edition: https://books.google.rw/books?id=SawgZ-uOF1EC&pg=PA72&dq=Linear+equation+in+n+variables&hl=en&sa=X&ved=0ahUKEwjNqPLRrofNAhWhK8AKHVwCA_wQ6AEITjAI#v=onepage&q=Linear%20equation%20in%20n%20variables&f=false

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Originally Written and Owned by TUYIHIMBAZE Serge.

The work was firstly proved to be true since 2012 until 2016 in Research.

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T SERGE'S THEOREM AND FORMULAE FOR A SINGLE EQUATION OF TWO OR MORE UNKNOWNS

The 1st **T.Serge's theorem states that:** the values of two or more unknowns in a single equation could be defined from $]-\infty, +\infty[$ and the interval between the values of the same sign should be constant.

The 2nd T.Serge's theorem states that: the next value **(Nv)** of unknown is directly proportional to the selected real number from $]-\infty, +\infty[$ **(TS)** times constant **(K)** but for multiplied unknowns and powered unknowns the first value remains constant.

The 3rd T.Serge's theorem states that: when a single equation has $\propto_1$ only the summation $(\propto_T)$ must be different from zero, if$(\propto_T) = 0$, you must add a selected real number from $]-\infty, +\infty[$ **(TS)** in both sides.

$$Nv \propto TS \implies Nv = TS * K$$

T.Serge's Theorem's links

The 1st link states that: the constant **(K)** value is equal to a half of summation of middle value and smallest value where the number of unknowns is even and it is a half of difference of smallest value and middle value where the number of unknowns is odd.

Formula where the number of unknowns is even	Formula where the number of unknowns is odd
$K = \frac{M + S}{2}$	$K = \frac{S - M}{2}$

The 2nd link states that: the selected real number (TS) goes with the sign of the value of unknown that is used and that value must be added to the product of selected real number **(TS)** and constant **(K)**

$$TS = (\pm)(]-\infty, +\infty[) \implies Nv = (\pm)TS * K + V$$

The overall formulae where:

(i) **The table of how to fill data of given single equation of two or more unknowns :**

Consider that: the integers are a and b, then the unknowns are X and Y

E.g.: $X + a = Y - b$

TSF	a	-b	a+(-b)	
X	X+a	-b-X	Answer X1	Answer X2
Y	a-Y	Y-b	Answer Y2	Answer Y 1

- ✓ **The next step is to equate diagonally each shaded cell of an equation with the summation of integers**
- ✓ **For the shaded cells in column 2 and 3 are in first diagonal, and the other two are in second diagonal and it is the same as from the column 4**
  i.e.: - shaded cells in column 2 and 3 → shaded cells in column 4
  - clear cells in column 2 and 3 → clear cells in column 4

N.B: each diagonal goes with its answers **e.g.:** X+a, Y-b and –b-X, a-Y

(ii) **To find next value :** $Nv = (\pm)TS * K + V$

SIMPLE EXAMPLES

Single Equation of two unknowns

1. $2X + 20 = 40 - Y$
2. $6X - 18 = 24 + 3Y$
3. $4X + 14 = 2Y - 28$
4. $2X + 16 - 3Y = 28 - 6X + 2Y$

Single Equation of three unknowns

5. $2X + 12 - Z = 3Y + 8 + Z$
6. $6Y + 2X + 18 = 4Z + 16$

Single Equation of four unknowns

7. $2X + 14 - 8Y = 4Z + 18 + 6Q$
8. $2X + 16 - 3Z = 28 - 6T + 2Q$

Single Equation of powered unknowns

9. $X^2 + 2X + 12 - 3Y = 7Y + 24 - Y^2$
10. $X^2 - 15X - 6 = -Y^2 + Y - 56$
11. $\frac{\sqrt{X+2}}{Y^2+6Y+8} = \frac{3}{(x+2)^{3/2}}$
12. $(X + 1)^2 + (Y + 2)^2 + (Z - 4)^2 = 5$

Single Equation of multiplied unknowns

13. $4P^2 + 8XP + 6P = 2\pi$
14. $Y(Z + {}^1/_X) = {}^1/_X(12 - Z) - 1$
15. $X + Y + Z + XYZ = 12$

$X = 20$
$y = -20$

$V = 2X$
$NV = \frac{1}{2}TS\left(\frac{M+J}{2}\right) + V$

$2X = 1\left(\frac{40+20}{2}\right) + 40$
$2X = 70$ $\quad X = 35$
$-y = -1\left(\frac{40+20}{2}\right) - 20$
$-y = -30 - 20$
$-y = -50$
$y = 50$

WRITE BELOW YOUR OBSERVATIONS AND YOUR CONCLUSION ABOUT THE PRESANTATION:

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.....

.....

.....

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CONCLUSION:

SHORT FORMULEA FOR THE SINGLE EQUATIONS OF TWO OR MORE UNKNOWNS

Je T.Serge's formulae includes table to solve the single equation, but it has short formulae proved by the table. The equation may include; $\propto_1, \propto_2, \propto_n$

The summation of integers in left hand side (LHS) is and for right hand side (RHS) is $\propto_2$ but the summation of them is, $\propto_T$

Where $(\propto)$ represents integers from $]-\infty, +\infty[$

1. For single equations of two unknowns with a single $(\propto)$ and with more than one $(\propto)$

The single equation some time may include $\propto_1$ *and* 0 in the other side.

The values will be $\boxed{\mathbf{X} = \frac{\propto_T}{a} \text{ and } \mathbf{Y} = \frac{\propto_T - \propto_1}{-b}}$ ..... **(i)**

The 3rd link states that: When the single equation includes; $\propto_1$ *and* $\propto_2$ each in its own side, they will not be displaced in the other side.

Therefore $\boxed{\mathbf{X} = \frac{\propto_T - \propto_1}{a} \text{ and } \mathbf{Y} = \frac{\propto_T - \propto_2}{-b}}$ ..... **(ii)**

Proves for above expressions:

From (i):

$aX + bY = \propto$

$aX = \propto_1 - bY$ Therefore; $\propto_T = 0 + \propto_1$

TSF	0	$\propto_1$	$\propto_T$	
aX	$aX+0$	$\propto_1 - aX$	$\frac{\propto_T}{a}$	$\frac{\propto_T - \propto_1}{-a}$
$-by$	$0 + by$	$\propto_1 - bY$	$\frac{\propto_T}{b}$	$\frac{\propto_T - \propto_1}{-b}$

From first diagonal

- $\mathbf{aX + 0} = \propto_T \implies X_1 = \frac{\propto_T}{a}$
- $\propto_1 - \mathbf{bY} = \propto_T \implies -\mathbf{bY} = \propto_T - \propto_1 \implies Y_1 = \frac{\propto_T - \propto_1}{-b}$

From second diagonal

- $\propto_1 - \mathbf{aX} = \propto_T \implies X_2 = \frac{\propto_T - \propto_1}{-a}$
- $\mathbf{0 + by} = \propto_T \implies Y_2 = \frac{\propto_T}{b}$

$\propto_1 + \propto_2 = \propto_2 - by$

$\propto_1 \; ax = \propto_2 \; by$

$4 + 2x = 3 + 5y$

According to the 3rd theorem's link General.

From (ii):

$aX + \propto_1 = \propto_2 - bY$ Therefore; $\propto_T = \propto_1 + \propto_2$

TSF	$\propto_1$	$\propto_2$	$\propto_T$	
aX	$aX + \propto_1$	$\propto_2 - aX$	$\frac{\propto_T}{a}$	$\frac{\propto_T - \propto_1}{-a}$

by	$\alpha_1 + by$	$\alpha_2 - bY$	$\frac{\alpha_T}{b}$	$\frac{\alpha_T - \alpha_1}{-b}$

rom first diagonal

- $aX + \alpha_1 = \alpha_T \Rightarrow aX = \alpha_T - \alpha_1 \Rightarrow X_1 = \frac{\alpha_T - \alpha_1}{a}$
- $\alpha_2 + bY = \alpha_T \Rightarrow -bY = \alpha_T - \alpha_2 \Rightarrow Y_1 = \frac{\alpha_T - \alpha_2}{-b}$

$X = \frac{60 - 20}{2} = 20$

$y = \frac{60 + 10}{+1} = +20$

From second diagonal

- $\alpha_2 - aX = \alpha_T \Rightarrow X_2 = \frac{\alpha_T - \alpha_2}{-a}$
- $\alpha_1 + by = \alpha_T \Rightarrow Y_2 = \frac{\alpha_T - \alpha_1}{b}$

2. For single equations of three unknowns with a single (α)

$aX + bY + cZ = \alpha$

$aX + bY = \alpha_1 - cZ$ Therefore; $\alpha_T = 0 + \alpha_1$

TSF	0	α_1	α_T	
$aX + bY$	$aX + bY$	$\alpha_1 - aX - bY$		
$-cZ$	$0 - cZ$	$\alpha_1 - cZ$	$\frac{\alpha_T}{-c}$	$\frac{\alpha_T - \alpha_1}{-c}$

From first diagonal, $Z = \frac{\alpha_T - \alpha_1}{-c}$

- $aX + bY = \alpha_T$ let $\alpha_T = \alpha_3$
- $aX + bY = \alpha_3$
- $aX = \alpha_3 - bY$

TSF	0	α_3	α_T	
AX	$aX + 0$	$\alpha_3 - aX$	$\frac{\alpha_T}{a}$	$\frac{\alpha_T - \alpha_3}{-a}$
$-bY$	$0 + bY$	$\alpha_3 - bY$	$\frac{\alpha_T}{b}$	$\frac{\alpha_T - \alpha_3}{-b}$

From first diagonal,

$X = \frac{\alpha_T}{a}$ and $Y = \frac{\alpha_T - \alpha_3}{-b}$ **as from equation (i)**

Then you prove the same way in the second diagonal

For single equation of three unknowns with more than one (α) General.

e.g.: $aX + bY - cZ + \alpha_1 = -\alpha_2$ Some time an equation may be in this form, it must be transformed in the following form

$aX + bY + \alpha_1 = -\alpha_2 + cZ$

TSF	α_1	$-\alpha_2$	α_T	
$aX + bY$	$aX + bY + \alpha_1$	$-\alpha_2 - (aX + bY)$		
CZ	$\alpha_1 - cZ$	$-\alpha_2 + cZ$		

$\alpha_{T_1} = \alpha_1 + \alpha_2$

From the first diagonal

$-\alpha_2 + cZ = \alpha_T$

aX + bY + α_1

$ax + by + \alpha_1 = \alpha_T$

$ax + \alpha_1 = \alpha_T - by$

- $aX + bY + \alpha_1 = \alpha_T$, let $\alpha_T = \alpha_3 \Rightarrow \alpha_1 + \alpha_3 = \alpha_{T_2}$
- $aX + \alpha_1 = \alpha_3 - bY$

From left hand side:

- $aX + \alpha_1 = \alpha_T \Rightarrow X = \frac{\alpha_T - \alpha_1}{a}$ - - - (i)

From right hand side:

- $\alpha_3 - bY = \alpha_T \Rightarrow Y = \frac{\alpha_T - \alpha_3}{-b}$ - - - (ii)

$-\alpha_2 + cZ$

- $-\alpha_2 + cZ = \alpha_T \Rightarrow Z = \frac{\alpha_T - \alpha_2}{c}$ - - - (i)

3. For single equations of four unknowns with a single(α)

$aX + bY + cZ + dT = \alpha$

$aX + bY = \alpha_1 - cZ - dT$ Therefore; $\alpha_T = 0 + \alpha_1$

TSF	0	α_1	α_{T1}	
$aX + bY$	$aX + bY + 0$	$\alpha_1 - aX - bY$		
$-cZ - dT$	$0 - (cZ + dT)$	$\alpha_1 - cZ - dT$		

From first diagonal,

From: $aX + bY = \alpha_T$

- let $\alpha_{T1} = \alpha_2$
- $aX + bY = \alpha_2$
- $aX = \alpha_2 - bY$

TSF	0	α_2	α_{T2}	
aX	$aX + 0$	$\alpha_2 - aX$	$\frac{\alpha_T}{a}$	$\frac{\alpha_T - \alpha_2}{-a}$
$-bY$	$0 + bY$	$\alpha_2 - bY$	$\frac{\alpha_T}{b}$	$\frac{\alpha_T - \alpha_2}{-b}$

From first diagonal,

$\mathbf{X = \frac{\alpha_{T2}}{a}}$ And $\mathbf{Y = \frac{\alpha_{T2} - \alpha_2}{-b}}$ **as from equation (i)**

From: $\alpha_1 - cZ - dT$ Without dealing with TSF table

- let $\alpha_{T1} = \alpha_3$
- $\alpha_1 - cZ - dT = \alpha_3$
- $\alpha_1 - cZ = \alpha_3 + dT$
- $\alpha_1 - cZ = \alpha_3 + dT$, $\Rightarrow \alpha_1 + \alpha_2 = \alpha_{T3}$, equate each side with α_{T3}

From left hand side:

- $\alpha_1 - cZ = \alpha_{T3} \Rightarrow Z = \frac{\alpha_{T3} - \alpha_1}{-c}$

From right hand side:

- $\alpha_3 + dT = \alpha_T \Rightarrow T = \frac{\alpha_{T3} - \alpha_3}{d}$

Then you prove the same way in the second diagonal

$ax + by + \alpha_1 = \alpha_3$

$ax + \alpha_1 = \alpha_3 - by$

$\alpha_{T_2} = \alpha_1 + \alpha_3$

$ax + \alpha_1 = \alpha_{T_2}$

$\frac{ax}{a} = \frac{\alpha_{T_2} - \alpha_1}{a}$

$x = \frac{\alpha_{T_2} - \alpha_1}{a}$

$2x + y + z = 4 + z$

$x = \frac{8-2}{2} = 3$

$y = \frac{8-6}{-1} = -2$

$z = 6 - 4 = 2$

$(\alpha_{T_2} = \alpha_{T_1} + \alpha_{T_2}$

here it can be $z = \frac{\alpha_{T_3} - \alpha_1}{+c}$

ngle equation of four unknowns ~~by~~ with more than one ($\propto$) General.

$\therefore aX + bY - cZ + dT + \propto_1 = + \propto_2$ Some time an equation may be in this form, it must be transformed in e following form

$aX + bY + \propto_1 = + \propto_2 + cZ - dT$

TSF	$\propto_1$	$+\propto_2$	$\propto_T$	
$aX + bY$	$aX + bY + \propto_1$	$+\propto_2 - (aX + bY)$		
$cZ - dT$	$\propto_1 - (cZ - dT)$	$+\propto_2 + cZ - dT$		

From the first diagonal

$aX + bY + \propto_1$

- $aX + bY + \propto_1 = \propto_T$, let $\propto_{T_1} = \propto_3$
- $aX + \propto_1 = \propto_3 - bY \implies \propto_1 + \propto_3 = \propto_{T_2}$ equate each side with $\propto_{T_2}$

From left hand side:

- $aX + \propto_1 = \propto_{T_2} \implies X = \frac{\propto_{T_2} - \propto_1}{a}$ ------(i) $X = \frac{\propto_{T_2} - \propto_1}{|a|}$

From right hand side:

- $\propto_3 - bY = \propto_T \implies Y = \frac{\propto_{T_2} - \propto_3}{-b}$ ------(i) $Y = \frac{\propto_{T_2} - \propto_3}{|b|}$

$+\propto_2 + cZ - dT$

- $+\propto_2 + cZ - dT = \propto_{T_2}$, let $\propto_{T_2} = \propto_4$
- $+\propto_2 + cZ = \propto_4 + dT \implies \propto_2 + \propto_4 = \propto_{T_3}$ equate each side with $\propto_{T_3}$

From left hand side:

- $+\propto_2 + cZ = \propto_{T_3} \implies Z = \frac{\propto_{T_3} + \propto_2}{c}$ ------(i) $Z = \frac{\propto_{T_3} - \propto_2}{|c|}$

From right hand side:

- $\propto_4 + dT = \propto_{T_3} \implies T = \frac{\propto_{T_3} - \propto_4}{d}$ ------(i) $T = \frac{\propto_{T_3} - \propto_4}{|d|}$
-

NOTES:

1. The answer for the values of unknowns will depend on the side where they are located either left hand side (LHS) or right hand side (RHS).
2. When a certain unknown has zero as a value, to find next value (TS) the unknown goes with its coefficient where they are more than one in a side.
3. If a coefficient of X or Y is a divisible of $\propto_1$ *or* $\propto_2$ you put it in different side from those in order to get the whole numbers.

for $ax^n + by^m + cz^p + dt^s = \alpha$

$$\Rightarrow x = \sqrt[n]{\frac{\alpha_{T_2}}{|a|}}$$

$$y = \sqrt[m]{\frac{\alpha_{T_2} - \alpha_2}{|b|}}$$

$$z = \sqrt[p]{\frac{\alpha_{T_3} - \alpha_1}{|c|}}$$

$$t = \sqrt[s]{\frac{\alpha_{T_3} - \alpha_1}{|d|}}$$

$$ax^n + by^m + cz^p + dt^s + \alpha_4 = \alpha_x$$

$$x = \sqrt[n]{\frac{\alpha_{T_2} - \alpha_1}{|a|}}$$

$$y = \sqrt[m]{\frac{\alpha_{T_2} - \alpha_3}{|b|}}$$

$$z = \sqrt[p]{\frac{\alpha_{T_3} - \alpha_2}{|c|}}$$

$$t = \sqrt[s]{\frac{\alpha_{T_3} - \alpha_4}{|d|}}$$

The formular that can be used to solve certain ~~equa~~ single equation like the follows

$ax^n + by^m + cz^p - d^s + \alpha + a$

$ax^n + by^m + cz^p + dt^s = \alpha$

$ax^n + by^m = \alpha - (cz^p + dt^s)$

$ax^n + by^m = \alpha - cz^p - dt^s$

TSF	0	α	α_T
$ax^n + by^m$	$ax^n + by^m$	$\alpha - ax^n - by^m$	
$-(cz^p + dt^s)$	$0 + cz^p + dt^s$	$-cz^p - dt^s$	

1. From the first Diagonal.

$ax^n + by^m = \alpha_T$ --- (i)

$-cz^p - dt^s = \alpha_T$ --- (ii)

2. From the second diagonal.

$\alpha - ax^n - by^m = \alpha$ --- (i)

$0 + cz^p + dt^s = \alpha$ --- (ii)

1a) the First Diagonal eqn (i)

$ax^n + by^m = \alpha$

$ax^n = \alpha - by^m$

TSF	0	α	α_T
$0x^n$	ax^n	$\alpha - ax^n$	
$-by^m$	$0 + by^m$	$\alpha - by^m$	

$ax^n = \alpha$

$x^n = \frac{\alpha}{a}$

$\boxed{x = \sqrt[n]{\frac{\alpha}{a}}}$

$x^3 = \sqrt[3]{\frac{0}{1}}$

$x = \sqrt[3]{\frac{2}{1}}$

100%

a, b

$0x^3 + 0x^3$

$= \sqrt{0}$

if $\alpha \pm$

if $\alpha = 0$

we can good that each side has added value

$= 0$

$\alpha = \alpha$ $\boxed{x = 20}$ $x = \frac{40}{2}$

$\alpha = 0$, $x = \frac{60 - 20}{2}$

$\boxed{y = -20}$ $y = \frac{20}{-1}$

$60 + 20 = 40 + 20$

$80 = 60$

$y = \frac{60 - 40}{-1}$

$x = \frac{60}{2}$ $x = 30$

$2x + 20 = 40 - y$ $x =$

$X = \frac{\alpha_T + }{a}$ $Q = \frac{28+16}{2}$ $z = \frac{28-44}{-3}$ $Q = \frac{-16}{-3}$ $\boxed{z = 5.3}$

$Y = \frac{\alpha_T - \alpha}{-b}$ $\boxed{Q = 22}$

$X = \frac{\alpha_T + \alpha_1}{a}$ $2Q - 16 = 44 - 3z$

$Y = \frac{\alpha_T - \alpha_2}{-b}$

$\alpha - Cz = \alpha_T$

$Cz = \frac{\alpha_T - \alpha}{c}$ $z = \frac{\alpha_T - \alpha_1}{-c}$

$z = \frac{\alpha_T - \alpha}{c}$ $\alpha_1 = 44$.

$2x + 16 - 3z = 44$ $z = \frac{\alpha_T - \alpha_2}{d}$ $2Q + 3z - 16 = 44$

$2x + 12 - z = 34 + 8 + t$ $\alpha_1 + \alpha_2 = \alpha_T$

$2x - z = 3y + z + 8 - 12$

$2x - 2z = -4 + 3y$

$2x + 16 - 3z = 28 - 6T + 2Q$

$16 = \alpha_1$ $14 + 16 - 14 = 28 - 8 + 8$

$28 = \alpha_2$

$X = \frac{44+16}{2} = 14 \Rightarrow 14$

$Q = \frac{44-28}{2} = 8 \Rightarrow 8$

$z = \frac{44-16}{-3} = -9.333 = 14$

$T = \frac{44-28}{-6} = -2.666 = 8$

$28 + 16 - 3(-9.33) = 28 - 6(-2.66) + 16$.

$44 - 27.9 = 28 - 15.6 + 16$.

$16.1 = 28.4$.

$X = \frac{\alpha_T + \alpha_1}{a}$

$Y = \frac{\alpha_T - \alpha_2}{-b}$

$2x + 6T - 28 = 44$

$2x + 6T = 44 + 28$

$X = \frac{16+28}{2}$ $t = \frac{16-44}{-6}$

$X = \frac{44}{2}$ $X = 22$ $t = \frac{-28}{-6}$

$t = 4.6$