Title: Expansion of terms squared, square of a binomial, trinomial, tetranomial and pentanomial.

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Abstract: This document develops and demonstrates the discovery of a new square potentiation algorithm that works absolutely with all the numbers using the formula of the square of a binomial, trinomial, tetranomial and pentanomial.

Chapter 1 Square of a binomial, trinomial, tetranomial and pentanomial.

Example nº1, Square potentiation algorithm, (Binomial)

We will use the number 17.
1=x
7=y

$$(x+y)^2 = (x+y)*(x+y)$$

$$\boxed{x^2 + 2xy + y^2}$$

$$17^2 = 1^2+2*1*7+7^2$$
$$17^2 = 1+14+49$$

Now we add using the following method.

$17^2 = 289$

	1			*100
	1	4		*10
+		4	9	*1
	2	**8**	**9**	Result

The blue figure is a pattern that will be present in all the numbers of two digits squared.
We multiply the first term by 100, the second term by 10, and the third term by 1. In all cases when we use the square of a whole number.

Coefficient of terms

$$\boxed{x^2 + 2xy + y^2}$$

121

$$11^2=121$$

Example n°2 Square potentiation algorithm, (Trinomial)

258² = 66.564
2=x
5=y
8=z

$$(x+y+z)^2 = (x+y+z)*(x+y+z)$$

$$x^2 \overbrace{+xy+xz+yx}^{\text{3 terms}}+ y^2 \overbrace{+yz+zx+zy}^{\text{3 terms}}+ z^2$$

$$\boxed{x^2 + \underbrace{2xy +2xz}_{\text{2 terms}} + y^2+ \underbrace{2zy}_{\text{1 term}} + z^2}$$

$$2^2 + 2*2*5+2*2*8 + 5^2+2*8*5 + 8^2$$

4 + 20 + 32 + 25 + 80 + 64

	4					*10.000
	2	0				*1.000
		3	2			*100
		2	5			*100
			8	0		*10
+				6	4	*1
	6	6	5	6	4	Result

The shape that is formed here is a pattern that will always be formed when we have three squared digits.
We can see that the geometric figure contains the figure of example 1 (square of a binomial).
We add following this model, ordering the numbers from left to right by moving them one place. the square of the letter Y will always be placed below the previous one and the following numbers will continue to move to the right one place.

Coefficient of terms

$$\boxed{x^2 + 2xy +2xz + y^2+ 2zy + z^2}$$

122121

111^2= 12321

See chapter 3

Example n°3 Square potentiation algorithm, (Tetranomial)

$2513^2 = 6.315.169$

2=x
5=y
1=z
3=d

$$(x+y+z+d)^2 = (x+y+z+d)*(x+y+z+d)$$

$$x^2 \overbrace{+xy+xz+xd+yx+}^{\text{4 terms}} y^2 \overbrace{+yz+yd+zx+zy+}^{\text{4 terms}} z^2 \overbrace{+zd+dx+dy+dz+}^{\text{4 terms}} d^2$$

$$\boxed{x^2 + \underbrace{2xy+2xz+2xd}_{\text{3 terms}} + y^2 + \underbrace{2zy+2yd}_{\text{2 terms}} + z^2 + \underbrace{2dz}_{\text{1 term}} + d^2}$$

$$2^2 + 2*2*5 + 2*2*1 + 2*2*3 + 5^2 + 2*1*5 + 2*5*3 + 1^2 + 2*3*1 + 3^2$$

$$4 + 20 + 4 + 12 + 25 + 10 + 30 + 1 + 6 + 9$$

	4								*1.000.000
	2	0							*100.000
		0	4					3 terms	*10.000
			1	2					*1.000
		2	5						*10.000
			1	0				2 terms	*1.000
				3	0				*100
				0	1				*100
					0	6		1 term	*10
+						0	9		*1
	6	**3**	**1**	**5**	**1**	**6**	**9**		Result

The figure is a pattern that will be formed with all the numbers with a maximum of 4 digits.
To add we use this model, ordering the numbers from left to right.
This pattern contains the patterns of examples 1 and 2 within itself.

$$\boxed{x^2 + 2xy+2xz+2xd + y^2 + 2zy+2yd + z^2 + 2dz + d^2}$$

1222122121

$1111^2 = 1234321$

See chapter 3

Example n°4 Square potentiation algorithm, (Pentanomial)

$25134^2 = 631.717.956$

2=x
5=y
1=z
3=d
4=g

$(x+y+z+d+g)^2 = (x+y+z+d+g)*(x+y+z+d+g)$

$$x^2 + \overbrace{xy+xz+xd+xg+yx}^{\text{5 terms}} + y^2 + \overbrace{yz+yd+yg+zx+zy}^{\text{5 terms}} + z^2 + \overbrace{zd+zg+dx+dy+dz}^{\text{5 terms}} + d^2 + \overbrace{dg+gx+gy+gz+gd}^{\text{5 terms}} + g^2$$

$$\boxed{x^2 + \underbrace{2xy+2xz+2xd+2xg}_{\text{4 terms}} + y^2 + \underbrace{2zy+2yd+2yg}_{\text{3 terms}} + z^2 + \underbrace{2dz+2zg}_{\text{2 terms}} + d^2 + \underbrace{2dg}_{\text{1 term}} + g^2}$$

$2^2 + \underline{2*2*5} + \underline{2*2*1} + \underline{2*2*3} + \underline{2*2*4} + 5^2 + \underline{2*1*5} + \underline{2*5*3} + \underline{2*5*4} + 1^2 + \underline{2*3*1} + \underline{2*1*4} + 3^2 + \underline{2*3*4} + 4^2$

4 + 20 + 4 + 12 + 16 + 25 + 10 + 30 + 40 + 1 + 6 + 8 + 9 + 24 + 16

	4									*100.000.000
	2	0								*10.000.000
		0	4							*1.000.000
			1	2						*100.000
				1	6					*10.000
		2	5							*1.000.000
			1	0						*100.000
				3	0					*10.000
					4	0				*1.000
				0	1					*10.000
					0	6				*1.000
						0	8			*100
						0	9			*100
							2	4		*10
+								1	6	*1
	6	3	1	7	1	7	9	5	6	Result

The figure is a pattern that will be formed with all the numbers with a maximum of 5 digits.
To add we use this model, ordering the numbers from left to right.
This pattern contains the patterns of examples 1,2 and 3 within itself.

The red numbers are the values that were squared in the formula. These are ordered multiplying each other by 100.
Example: 1; 100; 10.000; 1.000.000; 100.000.000

$x^2 + 2xy+2xz+2xd+2xg + y^2 + 2zy+2yd+2yg + z^2 + 2dz+2zg + d^2 + 2dg + g^2$

122221222122121

$11111^2 =$ 123454321

See chapter 3

Chapter 2: Coefficient of terms

Table 1 Construction of the coefficient of terms

Coefficients															Number of terms	Square		
														1	1	$(x)^2$	1	:1=1
												1	2	1	2	$(x+y)^2$	121	:11=11
									1	2	2	1	2	1	3	$(x+y+z)^2$	1.221	:111=11
					1	2	2	2	1	2	2	1	2	1	4	$(x+y+z+d)^2$	12.221	:1111=11
1	2	2	2	2	1	2	2	2	1	2	2	1	2	1	5	$(x+y+z+d+g)^2$	122.221	:11111=11

Table 2

Square	Number of terms	Number of Coefficients = Triangular numbers	Triangular numbers
$(x)^2$	1	1	1
$(x+y)^2$	2	121	3
$(x+y+z)^2$	3	122121	6
$(x+y+z+d)^2$	4	1222122121	10
$(x+y+z+d+g)^2$	5	122221222122121	15

Table 3

Square	Number of terms	The sum of the Coefficients equals the Perfect Square Numbers	Perfect Square Numbers
$(x)^2$	1	1	1
$(x+y)^2$	2	121	4
$(x+y+z)^2$	3	122121	9
$(x+y+z+d)^2$	4	12.22122121	16
$(x+y+z+d+g)^2$	5	122221222122121	25

The Numbers 2 of the coefficients are ordered progressively. Starting from a number 2, then two numbers 2, then three numbers 2 and so on. Numbers 2 correspond to double the product of the letters. The numbers 2 are always interspersed by numbers 1, which represent the letters squared.

Chapter 3) Square of polynomials

The square of the numbers 1, gives us a numerical value that at first sight does not seem to have any kind of relationship with the theme developed in this paper, but just as in Pascal's triangle we can obtain the expansion of a binomial, here with the square of the polynomials (binomial, trinomial, tetranomial, pentanomial, etc.) we obtain a value that is hidden in the power of them and forms the sequence of the coefficients of each term.

Example A Binomial

$(x+y)^2$

Right order of expression
$x^2 + 2xy + y^2$

Coefficient of terms

121

$$11^2=121$$

Example B Trinomial

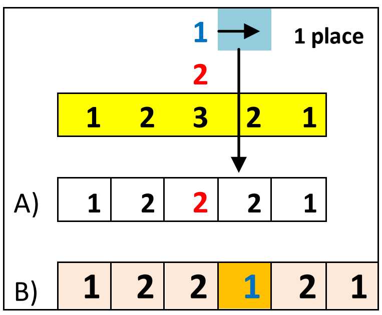
$(x+y+z)^2$

Right order of expression
$x^2 + 2xy + 2xz + y^2 + 2zy + z^2$

Coefficient of terms

122121

$$111^2 = 12321$$



The number 3 becomes (2 +1), At point A the number 2 goes down with the other numbers 2, At point B the number 1 moves one place to the right and then we lower it, running to the left the numbers that occupied that space.
In the following examples the development will be much clearer.

T =Terms
P= Places

P_1=T-2 P=3-2=1 (The one we moved 1 place)

For more information see chapter 4

Example C Tetranomial

$(x+y+z+d)^2$

Right order of expression
$x^2 + 2xy + 2xz + 2xd + y^2 + 2zy + 2yd + z^2 + 2dz + d^2$

Coefficient of terms

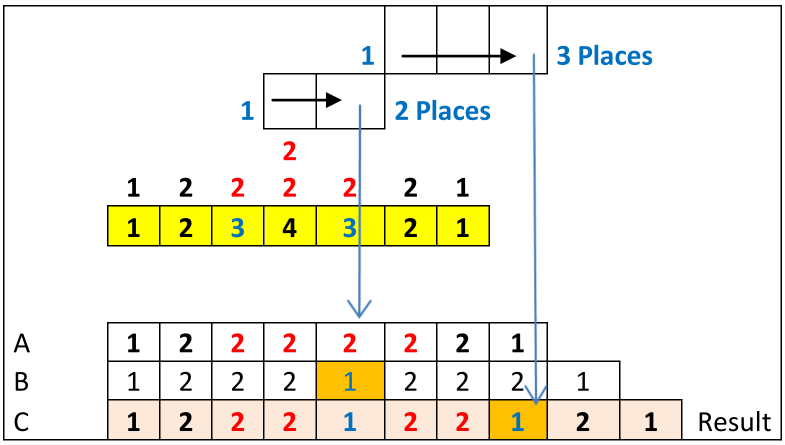
1222122121

$1111^2 = 1234321$

We convert numbers 3 and 4 into numbers 2 and 1

		1	2	1		
1	2	2	2	2	2	1
1	2	3	4	3	2	1

A) We order the numbers 2 side by side.
B) We move the first number 1 two places and lower it.
C) We move the second number 1 three places and lower it.



T =Terms
P= Places

P_1=T-2 **P=4-2=2** (The first one we moved 2 places)

For more information see chapter 4

Example D Pentanomial

$(x+y+z+d+g)^2$

Right order of expression
x^2 + 2xy+2xz +2xd+2xg + y^2+ 2zy+2yd+2yg + z^2+2dz +2zg+ d^2+ 2dg+ g^2

Coefficient of terms

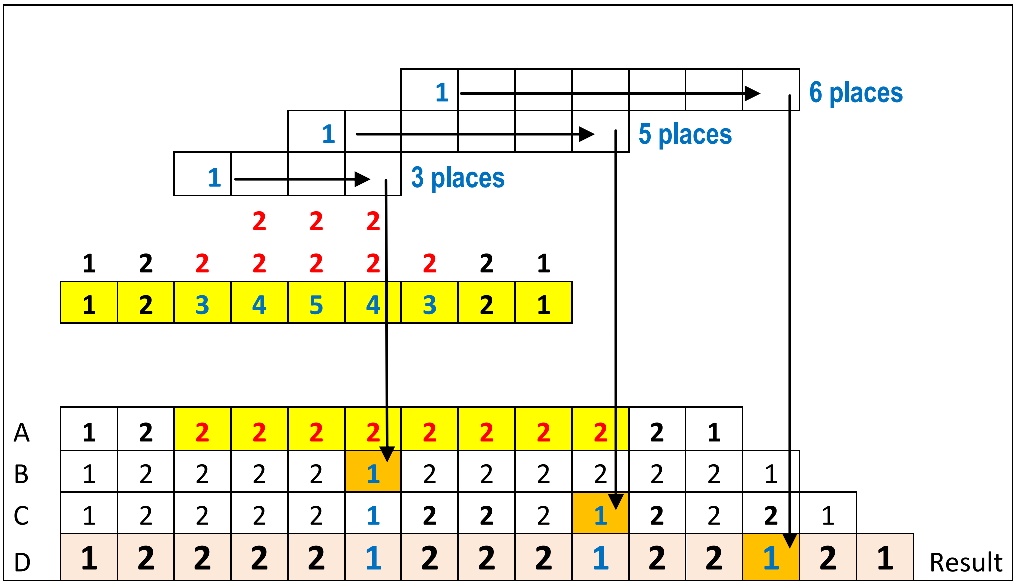
122221222122121

11111^2= **123454321**

We convert numbers 3, 4 and 5 into numbers 2 and 1

		1	2	1		
1	2	2	2	2	2	1
1	2	3	4	3	2	1

A) We order the numbers 2 side by side.
B) We move the first number 1 three places and lower it.
C) We move the second number 1 five places and lower it.
D) Finally we move the last number 1 six places and lower it.



T =Terms
P= Places

P_1=T-2 **P=5-2=3** (The first one we moved 3 places)
For more information see chapter 4

Example E Hexanomial

$(x+y+z+d+g+f)^2$

Right order of expression

$x^2 + 2xy+2xz+2xd+2xg+2xf + y^2 + 2zy+2yd+2yg+2yf + z^2+2dz+2zg+2zf+ d^2+ 2dg+2df+ g^2+2gf+ f^2$

Coefficient of terms

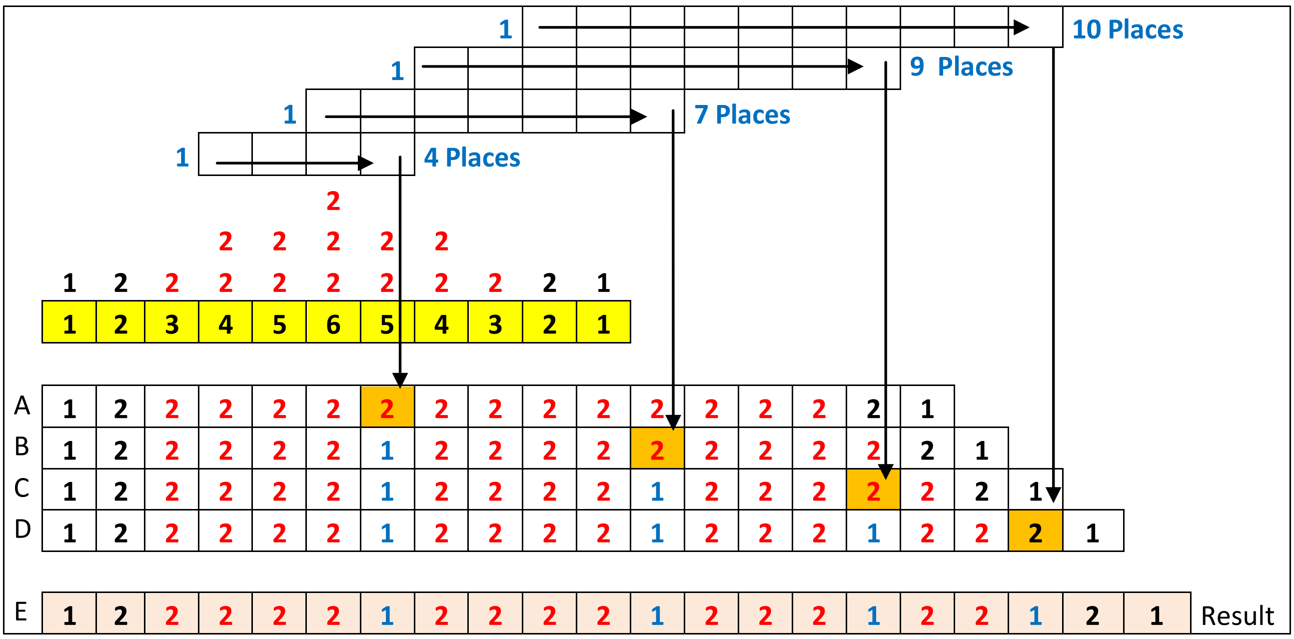
122222122221222122121

$111111^2 = 12345654321$

We convert numbers 3, 4, 5 and 6 into numbers 2 and 1

				1	2	1				
		1	2	2	2	2	2	1		
1	2	2	2	2	2	2	2	2	2	1
1	2	3	4	5	6	5	4	3	2	1

A) We order the numbers 2 (red) side by side.
B) We move the first number 1 four places and lower it.
C) We move the second number 1 seven places and lower it.
D) We move de third number 1nine places and lower it.
E) Finally we move the last number 1 ten places and lower it.



Chapter 4: Sequence of the numbers 1

The sequence of the numbers 1 corresponds to those that are located in the middle, not those of the extremes.

Example: Hexanomial, sequence 4, 7, 9, 10

Terms=T

T=6

The results belong to the boxes that the number 1 moves.

P= Places P1= first 1 P2= Second 1 P3= Third 1 P4= Four 1 The totality of numbers 1 that move is equal to P1 The totality of numbers 1 that exists per polynomial is equal to T.	A) P1=T-2 = 4 6-2
	B) P2=P1-1+P1=7 3 + 4
	C) P3=P1-2+P1-1+P1=9 2 + 3 + 4
	D) P4= P1-3+P1-2+P1-1+P1=10 1 + 2 + 3 + 4

Organization of the coefficients of the terms

																											1	1
																									1	2	1	2
																						1	2	2	1	2	1	3
																		1	2	2	2	1	2	2	1	2	1	4
													1	2	2	2	2	1	2	2	2	1	2	2	1	2	1	5
							1	2	2	2	2	2	1	2	2	2	2	1	2	2	2	1	2	2	1	2	1	6
1	2	2	2	2	2	2	1	2	2	2	2	2	1	2	2	2	2	1	2	2	2	1	2	2	1	2	1	7

Another way to organize the coefficients of the terms

Example A

1								1																				
2						1	2	1																				
3					1	2	2	1	2	1																		
4				1	2	2	2	1	2	2	1	2	1															
5			1	2	2	2	2	1	2	2	2	1	2	2	1	2	1											
6		1	2	2	2	2	2	1	2	2	2	2	1	2	2	2	1	2	2	1	2	1						
7	1	2	2	2	2	2	2	1	2	2	2	2	2	1	2	2	2	2	1	2	2	2	1	2	2	1	2	1

Example B

1	1																											
2	1	2	1																									
3	1	2	2	1	2	1																						
4	1	2	2	2	1	2	2	1	2	1																		
5	1	2	2	2	2	1	2	2	2	1	2	2	1	2	1													
6	1	2	2	2	2	2	1	2	2	2	2	1	2	2	2	1	2	2	1	2	1							
7	1	2	2	2	2	2	2	1	2	2	2	2	2	1	2	2	2	2	1	2	2	2	1	2	2	1	2	1

The totality of the numbers 2 coincides with the sequence of triangular numbers.
1, 3, 6,15, 21 etc.

Conclusion

This new algorithm presents a surprising precision, which transforms it into a reliable system or method for performing squared number operations.
This is simply different, it is a novel and interesting alternative.
The correct setting of the coefficients of the terms is fundamental to reselect the final addition operations.
This potentiation algorithm opens the door for the development of polynomials elevated to the cube, to the fourth, etc.
The numbers 1, 11, 1111, 1111, etc., squared, enclose in themselves the information on how the coefficients are ordered. The transformation method is very simple.

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