International Journal of Mathematics Trends and Technology
ISSN: 2231 – 5373 /doi:10.14445/22315373/IJMTT-V66I12P522
Volume 66 Issue 12, 161-169, December, 2020

A Solution of The Zero To The Power Zero and Any Number Divide by Zero

Sushankar Das
Assistant Teacher, Zadonang Memorial M.E. School, Choto Laisong, Dima Hasao, Assam, India.

Abstract: *In this article, we find a reasonable solution on the unsolved mathematical mystery divide by zero and zero to the power zero. From the time of discovery of zero, it is taught (most of the time) that we cannot divide by zero and we find another mathematical mystery zero to the power zero is undefined. Any number multiply by zero, we get the product as zero(zeroes). If zero as a digit or as a number takes part in multiplication it is necessery to take part in division because division is the inverse operation of multiplication. We find some dissimilarities in magnitude of digits of the products when we compare the products of zero and other numbers of various methods. Comparing with these various results or products of these various methods, we forward our study to find an effective result. A newly introduced method, namely two step method, is a precious method which shows the natural creation of digits after vertical multiplication. This new method is very fruitful to reach our goal. In this article, we apply our best opinions to find a popular solution of these operations in the light of basic mathematical (Arithmetic) operations and with the application of newly introduced algebraic formulas.*

Keywords: *Divide by Zero, zero to the power zero, two step method, multiplicative identity.*

Introduction

Let us study first the mathematical operations of our basic digits 0, 1, 2, ……8, 9, we find all the digits except "0" take part in all four major operations namely, addition, substraction, multiplication and division. We cannot divide any number or even "0" by "0". Another operation "0" to the power "0" is kept undefined.

In mathematical operations, division is the inverse operation of multiplication. If we find result after multiplication, it is necessary to find the result after division. Keeping this inverse view in mind, we proceed our study to find the result.

Question Arise- Whether our present multiplicational results (products) is perfect?
To find answer, we compare the multiplicational results (products) of various systems (methods)-
In our general method (Long multiplication)

1x2 = 2
1x2x3 = 6
2x0x5 = 0
0x0x0 = 0

In Lattice method –

1x2 = 02
2x0 = 00

In decimal system (without putting "0" before decimal point) –

˙1x ˙2= ˙02
˙1x˙2x˙3 = ˙006
˙5x˙2x˙0 = ˙000

Comparing the above three methods of multiplicational results (products), we observe disimilarities on creation of digits on products after multiplication.

Question Arise- Which method is perfect?

1. Natural creation of digits on products after multiplication-

To find answer, which method is perfect? We think it is the Indian decimal system of multiplication. In general multiplication too, the creation of digits on product maintain the rule of decimal system. Our present system neglects zero or zeroes before left side of any number or product.

In favour of our opinion, we apply a newly introduced method namely, **two step method**. The two step method is a perfect method to show the natural creation of digits on products after multiplication.

The two step method is a method based on digit wise multiplication. This two step method contains two steps-

1. Step1 and 2. Step2. Step 1 of this method contains the product of vertical digit or digits and step2 contains the result of the sum of crosswise products. After adding step1 and step2, we find the final result. A symbolic "o" is putted on block of one's place on step2 which is vary in number depending on digit or digits taken as single digit.

We find the two step method on a series of algebraic formulas. Here we apply only the formulas of 2 digits (ab) numbers-

Numbers		Step1 + Step2
$(ab)^2$	=	$a^2b^2 + 2ab|0$
$(ab)^3$	=	$a^3b^3 + 3a^2b|3ab^2|0$
$(ab)^4$	=	$a^4b^4 + 4a^3b|6a^2b^2|4ab^3|0$

And so on.

The number as power on "a" and "b" of Step1 indicate the creation of digits on products after vertical multiplication i.e. a^2 = 2 digits number, b^2 = 2 digits number, a^3 = 3 digits number and so on in their respective places.

Step1 of these formulas are very important to reach our goal. Here we apply the formulas on a 2 digits number 12 and observe -

1. $(12)^2 = 1^2 2^2 + 2.1.2|0$
   = 0104 + 004|0 (1x1 = 01, 2x2 = 04)
   = 0104 + 0040 (withdrawing block symbol)
   = 0144

2. $(12)^3 = 1^3 2^3 + 3.\ 1^2.2|\ 3.1.2^2|0$
   = 001008+0006|0012|0 (1x1x1 = 001, 2x2x2 = 008)
   = 001008+0007|2|0 (1 digit in each block)
   = 001008+000720 (withdrawing block symbols)
   = 001728

3. $(12)^4 = 1^4\ 2^4 + 4.1^3 2|\ 6.1^2.\ 2^2|\ 4.1.2^3|0$
   = 00010016 + 00008|00024|00032|0 (1x1x1x1 = 0001, 2x2x2x2 = 0016)
   = 00010016+ 00010|7|2|0 (1 digit in each block)
   = 00010016 + 00010720 (Withdrawing block symbols)
   = 00020736

[We may apply our present rule of multiplicational result on step 2]

Step1 of the above examples clearly show the natural creation of digits on product after multiplication and these creation of digits will lead us to find the result of our study.

Question Arise-Does "O" behave like other basic digits?

The present system teaches us that zero does not follow the same rules like all the other numbers and the multiplication property states that the product of any number and zero is zero. It does not matter what the number is, when we multiply it to zero, we get the result as zero.

We think our present system is unable to find our result. To find the answer of the above question, again we apply the formulas of two step method on the number 10 and 1002.

4. $(10)^2 = 1^2\ 0^2 + 2.1.0|0$
   = 0100 + 000|0 (1x1= 01, 0x0 = 00)
   = 0100 (As Step 2 = 0000)

5. $(10)^3 = 1^3\ 0^3 + 3.1^2.0|3.1.0^2|0$
   = 001000 + 0000|0000|0 (1x1x1= 001, 0x0x0 = 000)
   = 001000 (Step 2 = 0000)

6. $(10)^4 = 1^4\ 0^4 + \ldots..$ (Step2 results zeroes)
   = 00010000 (1x1x1x1 = 0001, 0x0x0x0 = 0000)

7. $(1002)^2 = (10)^2\ (02)^2 = 2.10.02|00$ (2 digits as b)
   = 0100 0004 + 40|00 $(10)^2 = 0100$, $(02)^2 = 0004$)
   = 01000004 + 4000 (withdrawing block)
   = 01004004

Comparing the examples 4,5,6,7 with the examples 1, 2, 3, we find that "0" creates equal number of digits like other basic digits and find-

1^2 = 1x1 = 01 -> 2 digits number
1^3 = 1x1x1 = 001 -> 3 digits number
2^2 = 2x2 = 04 -> 2 digits number
2^3 = 2x2x2 = 008 -> 3 digits number

Or 0^2 = 0x0 = 00 -> 2 digits number
0^3 = 0x0x0 = 000 -> 3 digits number
0^4 = 0x0x0x0 = 0000 -> 4 digits number

2. Zero Participates in zero divide by zero-

In our present system, we cannot divide any number by zero or even zero by zero. We can apply our two step method to proceed our goal.

In multiplication, unit's digit always results the unit's digit or digits of the product. If division is inverse operation of multiplication then unit's digit or digits will also take part in division and result the unit's digit of the quotient.

To find whether "O" results quotient like the other basic digits or not, we compare a study with natural numbers. Firstly we multiply some numbers and thereafter divide the products by multiplier.

Multiply		Divide the products	unit's digit / unit's digit
2x14	=28	28÷14 = 2	8÷4 = 2
2x13	= 26	26÷13 = 2	6÷3 = 2
2x11	= 22	22÷11 = 2	2÷1 = 2
6x5	=30	30÷5 = 6	(3)0÷5 = 6
10x10	= 100	100÷10 = 10	0÷0 = ?
100x100	=10000	10000÷100 = 100	00÷00 = ?

(00 as unit's digit using multi-digit as single digit)

We observe that when unit's digit of numerator and denominator are natural number it result the quotient as natural number and when we divide "0" by "0" or "00" by "00", we find equal number of zero or zeroes vanish (disappear) from the result.

We forward studying by digit-wise of the step1 of the examples 1.4, 1.5 and 1.6.

0^2 = 00 or, 1^2= 01
0^3 = 000 1^3= 001
0^4 = 0000 1^4= 0001

We again proceed backward from 0^4 to 0^0 and 1^4 to 1^1

0^4 = 0000 or, 1^4 = 0001
0^3 = 0000÷0 = 000 1^3 = 0001 ÷ 1 = 001
0^2 = 000÷0 = 00 1^2 = 001÷1 = 01
0^1 = 00÷0=0 1^1 = 01÷1 = 1
0^0 = 0÷0 = ?

It is proved that zero creates equal number of digits like other digits after multiplication and here we observe it maintain equal rule after division .

From the above patterns, we also observe that zero takes part in division and results the quotient as 1 (one) zero lesser than the dividend.

3. Result of "O" divide by "0" and "0" to the power"0"-

To find the answer how they vanish from the result, we forward the following patterns-

$(10)^4$ = 10000
$(10)^3$ = 10000÷10 = 1000.0 = 1000 (withdrawing ˙0)
$(10)^2$ = 1000÷10 =100.0 =100
$(10)^1$ = 100÷10 =10.0 =10
$(10)^0$ = 10÷10 = 1.0 =1

We again forward the following patterns considering examples 1.4, 1.5 and 1.6 to reach our goal-

0^4 = 0000
0^3 = 0000÷0 = 000.0 = 000 (withdrawing ˙0)

$0^2 = 000 \div 0 = 00.0 = 00$
$0^1 = 00 \div 0 = 0.0 = 0$
Considering above rule, we find-
$0^0 = 0 \div 0$ = ˙0 = ….. Neglected result(Vanishing result)

We find 0^o and 0/0 result the same answer ˙0 (point zero).

To verify our opinion (result), we again apply the multiplication of 10 by 10 and 300 by 200 using two step method. Step1 of the formula is responsible for our study

We know, 10x10 = (1x1) (0x0) = 0100 -> Step1

300x200 = (3x2) (00x00) = 060000 -> Step1 (00 = multi-digit as single digit)

To find multiplicand, we divide the product by the multiplier –

In 10x10, we find 1x1= 01 and 0x0= 00. We divide 01 by multiplier 1 and 00 by 0, we get 01÷1= 1 and 00÷0= 0˙0= 0. Setting in order, we find the multiplicand 10.

In 300x200, we find 3x2 = 06 and 00x00 = 0000. We divide by the multiplier 06 by 2 and 0000 by 00, we get 06÷2= 3 and 0000÷00 = 00˙00 = 00. Setting in order, we find the multiplicand 300.

From the above study, we find that zero or zeroes as unit's digit of denominator is responsible for decimal point only for unit's digit zero or zeroes on numerator.

In number system, "0" is the least digit. So ˙0 (point zero) is not a digit, it is only the divisional least result. We find it sometimes vanishes from the result such as 100/10=10 and it cannot be considered to take part in other mathematical operations lonely except multiplication because it is the result of division. Point zero (.0) or point zeroes (.00….) has/have existance in mathematics especially in decimal part of a decimal number.

When we divide a smaller number (dividend/numerator) by a bigger to bigger and bigger number (Divisor/Denominator), we proceed to find quotient as .0 (point zero) or point zeroes (.00…) but in our present system we represent this result as 0 (Zero) instead of point zero (.0) or point zeroes (.00…) without any reasonable clearification.

a. To prove Multiplicative Identity-

Generally zero has no multiplicative identity but it is necessery to prove our findings and for further result.

Multiplication inverse or reciprocal for a number x, denoted by 1/x or x^{-1}, is a number which when multiplied by x yields the multiplicative Identity 1. The multiplicative inverse of 0 is1/0 (where x = 0)

To find multiplicative identity-
0 x 1|0 = 1x 0/0
= 1x ˙0 (0/0 = ˙0)
= 1.0 (˙0 Becomes decimal part) [Explained later]
= 1

Or, 0 x 1/0 = 00÷0 (1x0 = 00)
= ① 0÷0 (1x0 = ① 0), [hidden 1 in a (bigger) zero]
= 1˙0 (00 = 1x0), (As per question only)

To verify 1x0 =①0, we apply step1 of two step method on the following illustration-

21x10 = (2x1) (1x0) = 0200

In 02= 2x1 and 00= 1x0 (As per rule)
We divide the product by the multiplier to find back our multiplicand and observe –
02 ÷ 1 = 2 (multiplier is 1)
00÷0 = 0˙0 = 0 (multiplier is 0)
In 00÷0, we find the multiplicand 0 in place of 1. Where is our fault? To find correct answer we should follow the rule that multiplicand and multiplier always hidden on the product. Applying the same logic i.e. after multiplication of 1x0, 1 is hidden in a zero in this form
1x0 =① 0 but not in the form 0① as 1x1 = 01.
Therefore, we may write ① 0÷0 = 1˙0 =1 Or,

00÷0 = (1x0) ÷0 = 1x 0|0 = 1x˙0 = 1.

[**Note**: In this article, we use 1 x 0 = ① 0, 5 x 0 = ⑤ 0 and so on instead of 00 for our better clarification to reach our findings]

Question may arise, we may write 00 equal to 2x0, 3x0 or 7x0 and so on. It is quite wrong because a product is the multiplicational result of the multiplicand and multiplier as per question only. If we do not follow this rule it yields us mathematical fallacies.

b. To avoid arithmetical fallacies:-

Arithmetical fallacies like 0 x 2 = 0 x 2 => 0/0 = 2/2 => 0/0 = 1, we should remember that zero is not a natural number and it is the least digit so it does not follow all the rules that we apply in case of multiplication of natural numbers or non zero integers.

To clarify, we multiply some natural numbers by other natural numbers and also a natural number by a zero for examples and observe-

1. 1x1=1
2. 1x2=2
3. 2x3=6
4. 5x0=0

Studying the above four examples, we find that in example 1, i.e, 1x1=1, the product is 1 which is equal to multiplicand or multiplier, In example 2, i.e, 1x2=2, we find the product is equal to greater number (multiplier) and in example 3, i.e, 2x3, the product is greater than the multiplicand or multiplier. In example 4, i.e, 5x0, we find fully an opposite product which is equal to lower number (multiplicand).

It is necessery to mention here that in case of division, we can apply repeated substraction method where dividend is a product of natural numbers but when zero is a dividend although it is the product we can not apply repeated substraction to find the quotient. Suppose 3x2=6, in this case we can apply 6-3=3, 3-3=0 but 2x0=0, in this case, we can not show 00-2=0.

To avoid arithmetical fallacies like the above equation, we must remember that division is the inverse operation of multiplicaton. Therefore, we think, we should follow PEMDAS rule instead of BODMAS rule for order of operation related to multiplication with or by zero (0).

Now we work with the above equation of the topic and observe-

0x2=0x2

=> 00=00 [Multiply first (PEMDAS)]

=> 0=0 [Withdrawing zero from both sides]

c. Division of zero product by zero:-

Considering the above observations, we think that if we divide 2x0= ②0 (00) by '0', we get back 2 but if we divide it by 2, we find the quotient only '0' as ② 0/2=0. Thus we may consider the division of the product of natural number and zero or simply to say 'zero product' by zero (0). Suppose we want to divide 5x0=⑤0 (00) by 0, we find ⑤ 0/0=5.0=5.

When we multiply by zero we find the product creates equal number of zeroes of the sum of the total digits of the multiplicand and multiplier. We think the digit or digits of the non zero number hidden inside the (product) left side zero or zeroes before the original zero or zeroes. In this case, we may consider that the negative sign is also hidden with the digit of the extreme left zero of the product because we can not put negative sign before the zero or 'zero product' i.e, product of non-zero integer and zero. Suppose we want to divide the product of -5x0 by 0. We may consider the product as -⑤0 form and when it divide by 0, we find -⑤0/0=-5.0. Thus (-12x0)/0= -①② 0/0= -12.0= -12 and so on.

4. Any number except zero divide by zero or n / 0 (where n ≠ 0):-

In our numbers system, 0 is the least digit and it is denoted for nothing. We know, zero takes part in multiplication and result zero (zeroes). In mathematics, division is the inverse operation of multiplication. So our query is whether zero takes part in division of all numbers except zero. We proceed considering the two important properties of division-

1. Dividend is the product of divisor and quotient where remainder is zero.
2. Dividend is equal to the product of divisor and quotient plus remainder.

In our present system, 1 digit number divide by 1 digit number, we may get 1 digit number as quotient. For instance 8÷2 = 4. If we apply the above 3.1 property of division, we observe that the dividend must be larger in digits than the divisor. For instance 4÷2 = 2. When we multiply divisor 2 by quotient 2, we get the product 04. What does it mean? In present system, we are always neglecting "0" before left side of any number or product.

Considering the lattice method, decimal system and two step method, we may say," Sum of the digits of divisor and quotient is equal to total digits of the dividend (accounting neglecting zero or zeroes).” If we divide 2 digits number by 1 digit number, we get 1 digit number as quotient and 3 digits number by 1 digit number , we get 2 digits quotient and so on.

Remembering the above rule, we apply the properties of division by taking dividend 25 and divisor 6.
We get quotient 4 and remainder 1.

Application of properties of division-
1. Dividend = Divisor X Quotient + Remainder
25 = 6 X 4 + 1 = 25
2. Quotient = (Dividend - Remainder) ÷ Divisor
4 = (25-1) ÷ 6 = 4
3. Divisor = (Dividend - Remainder) ÷ Quotient
6 = (25-1) ÷ 4 = 6
4. Remainder = Dividend – (Divisor X Quotient)
1 = 25 – (6X4) = 1
The above illustration satisfies all the properties of division.

To divide any non-zero number divide by zero, we forward remembering “0” is not a natural number and it is a digit denotes for nothing. So, if any non-zero number divide by “0” the quotient may be or may not be 1 digit lesser than the dividend.

Firstly, we proceed considering the view in mind, no divide, no quotient, all are remainder and observe the properties of division. We take dividend 25 and divisor “0”. 25 is a two digit number (product) and “0” is a one digit number. We consider 25÷0 equal to quotient 0 and remainder 25.

Application of properties of division-
1. Dividend = Divisor X Quotient + Remainder
25 = 0x0+25 =00+25 = 25
2. Quotient = (Dividend - Remainder) ÷ Divisor
0 = (25-25) ÷ 0 = 00†0 = 0˙0 = 0
3. Divisor = (Dividend - Remainder) ÷ Quotient
0 = (25-25) ÷ 0 = 00÷0 = 0
4. Remainder = Dividend – (Divisor X Quotient)
25 = 25 – (0X0) = 25-00 = 25
The above illustration satisfies all the properties of division.

We again apply 1 digit number 4 and divide it by “0”. We consider quotient 0 and remainder 4. We observe the properties of division-

Application of properties of division-
1. Dividend = Divisor X Quotient + Remainder
4 = 0x0 +4 = 00+4 = 04
2. Quotient = (Dividend - Remainder) ÷ Divisor
0 = (4-4) ÷ 0 = 0÷0 = ˙0 (point zero)
3. Divisor = (Dividend - Remainder) ÷ Quotient
0 = (4-4) ÷ 0 = 0÷0 = ˙0 (point zero)
4. Remainder = Dividend – (Divisor X Quotient)
4 = 4 – (0X0) = 4 - 00 = 04

The above illustration 4÷0, does not satisfy the properties of division. In properties 1 and 4, we get unequal digits in both sides and in 2 and 3, we got “0” equal to ˙0 (point zero).

Where is our fault? We apply the dividend only as a number but not written in product form.

To verify, we write the dividend 4 in product form 04 and divide it by 0. We apply the properties of division and observe-

Application of properties of division-
1. Dividend = DivisorXQuotient+Remainder
04 = 0x0+04 = 00+04 = 04

2. Quotient = (Dividend-Remainder)÷Divisor
0 = (04-04) ÷ 0 = 00÷0 = 0˙0 = 0

3. Divisor = (Dividend-Remainder)÷Quotient
0 = (04-04) ÷ 0 = 00÷0 = 0˙0 =0
4. Remainder = Dividend – (Divisor X Quotient)
04 = 04 – (0X0) =04 - 00 = 04

The above illustration also satisfies all the properties of division.

Now we apply the above dividend i.e, 25 and 04 in negative form and divide them by zero (0); and we observe the properties of division-

Firstly, we take the dividend -25 and divisor ‘0’. We consider quotient ‘0’ and remainder -25 as 0 can not be negative.

Application of properties of division-

1. Dividend = Divisor x Quotient + Remainder
 -25 = 0 x 0 + (-25) = 00 – 25 = -25
2. Quotient = (Dividend – Remainder) ÷ Divisor
 0 = {-25 – (-25)} ÷ 0 = 00 ÷ 0 = 0.0 = 0
3. Divisor = (Dividend – Remainder) ÷ Quotient
 0 = {-25 – (-25)} ÷ 0 = 00 ÷ 0 = 0.0 = 0
4. Remainder = Dividend – (Divisor x Quotient)
 -25 = -25 – 0x0 = -25 - 00 = -25

Again we apply dividend as -04 and divisor ‘0’ we consider quotient ‘0’ and remainder -04.

Application of properties of division-

1. Dividend = Divisor x Quotient + Remainder
 -04 = 0 x 0 + (-04) = 00 – 04 = -04
2. Quotient = (Dividend – Remainder) ÷ Divisor
 -04 = {-04 – (-04)} ÷ 0 = 00 ÷ 0 = 0.0 = 0
3. Divisor = (Dividend – Remainder) ÷ Quotient
 0 = {-04 – (-04)} ÷ 0 = 00 ÷ 0 = 0.0 = 0
4. Remainder = Dividend – (Divisor x Quotient)
 -04 = -04 – 0 x 0 = -04 - 00 = -04

The above illustrations too satisfy all the properties of division. When we divide the dividend of any non-zero integer in product form by ‘0’ (zero), considering quotient as zero or zeroes and the number of the dividend as a remainder satisfy all the properties of division.

We have already observed that when we divide the dividend of any non-zero integer in a zero product form by zero, we get the quotient as a non-zero integer. Now we apply various properties of division on zero product form and observe-

If we multiply 25 by 0, we get the product as ②⑤0 from and -25 x 0, we get the product as (-2)⑤0 form (zero product form).

We take the positive dividend first i.e,②⑤ 0 and divisor ‘0’. We consider the quotient as 25 and remainder as ‘0 0 0’ or ‘0’.

[In this article we use 2 x 0 =②0, 25 x 0 =②⑤ 0 and - 25 x 0 =(-2)⑤ 0 and so on instead of 2 x 0 = 00, 25 x 0 = 000 and so on respectively just to understand and identify the digits (number) hidden on the zeroes of zero product.]

Application of properties of division-

1. Dividend = Divisor x Quotient + Remainder
 ②⑤0 = 0 x 25 + 000 =②⑤0 + 000 =②⑤0
2. Quotient = (Dividend – Remainder) ÷ Divisor
 25 = (②⑤0 - 000) ÷ 0 =②⑤0 ÷ 0 = 25.0 = 25
3. Divisor = (Dividend – Remainder) ÷ Quotient
 0 = {②⑤0 - 000} ÷ 0 = ②⑤ 0 ÷ 0 = 25.0 = 0
4. Remainder = Dividend – (Divisor x Quotient)
 000 =②⑤0 – (0 x 25) =②⑤0 –②⑤0 = 000

Now we take the negative dividend i.e, (-2)⑤ 0 and divisor ‘0’, we consider quotient ‘- 25’ and the remainder ‘000’ or ‘0’.

Application of properties of dividion-

1. Dividend = Divisor x Quotient + Remainder
 (-2)⑤0 = 0 x (-25) + 000 = (-2)⑤0 + 000 = (-2)⑤0
2. Quotient = (Dividend – Remainder) ÷ Divisor
 -25 = ((-2)⑤0 - 000) ÷ 0 = (-2)⑤0 ÷ 0 = -25.0 = -25

3. Divisor = (Dividend – Remainder) ÷ Quotient
   0 = (-②⑤0 – 000) ÷ (-25) = 000 ÷ (-25) = 0
4. Remainder = Dividend – (Divisor x Quotient)
   000 = -②⑤0 – {0 x (-25)} = -②⑤0 – 2 5 0 = 000

We observe that these illustrations also satisfy all the properties of division. After observation of these two rules, a question arise which is the correct quotient? Whether is it ‘0’ or non-zero integers?

To find the answer, we may consider that ‘0’ is the least digit and it is lesser than 1 in value. When we divide any non-zero number by 1, we get the dividend as quotient in return. Applying lesser value view in mind, we may consider that any non-zero number including “zero product” divide by zero, whether the number in product form or not, we cannot consider ‘0’ as quotient unless dividend is the product of zero and zero or zeroes. Also we observe that in case of negative dividend, the quotient ‘0’ becomes positive because we cannot put ‘-‘sign before quotient ‘0’ which breaks the rule of division. So ‘0’ never be considered as the quotient for above illustrations.

d. An integer as dividend:-

From the above study, we may consider that we can divide by zero and it maintains all the properties of division.

In our present system, we do not think of the dividend in product form as we write the product form in Lattice method or in Two step method of multiplication. Suppose, 8 is divided by 4, we get the quotient as 2. If we think the dividend in product form then it is written 08 ÷ 4 = 2 because we get 8 as the product of 1 x 8 or 2 x 4 which result 08 (product form).

Now, we apply first property of division to divide 8 by 4. We get quotient 2 and remainder ‘0’.

Application of property of dividion-

Dividend = Divisor x Quotient + Remainder

8 = 4 x 2 + 0 = 08

We get, 8 (integer) = 08 (product).

In case of fractional division, we face the same problem. Suppose, we take an example 6 by 12 i.e, 6 / 12, we get 6 / 12 = .5 . When we apply the property-

Numerator = Quotient x Denominator + Remainder,

We find, 6 = .5 x 12 + 0 = 06, i.e, 6 (integer) = 06 (product)

Why do we face these problems? To find answer, we actually apply two types of method of multiplication- (1) Long multiplication method which teaches us 2 x 3 = 6 or 4 x 2 = 8 and (2) Lattice method or Two step method which teaches us 2 x 3 = 06 or 4 x 2 = 08. Application of these two types of methods is necessary to reach our goal because long multiplication method lonely does not fulfill all the conditions necessary for the purpose.

In the above two cases 8 equal to 08 and 6 equal to 06, we find one digit number is equal to two digits number. We generally neglect ‘0’ before the left side of any number without showing reasonable rule or any clarification. In this situation, there must be a concrete rule by which we neglect the ‘0’ or zeroes before the left side of any number. Considering necessity, we may point out that to balance the digit or digits of the number of both side of an equation, we should divide the number of both side by 1 applying the rule of the two above mentioned method in case of non-zero integers because 1 is least natural number. Thus, dividing by 1, we get-

8 ÷ 1 = 08 ÷ 1 => 8 = 8 and 6 ÷ 1 = 06 ÷ 1 => 6 = 6

We think, to convert any non-zero product like 08, 06, 025 and so on into integer it is necessary to divide by 1 as many times it needs instead of saying neglect the zero before the number.

Remembering the above problems in mind, we proceed on the division of any non-zero number by ‘0’. Suppose, we want to divide 5 by ‘0’. If we consider 5 ÷ 0 = 5, we get

5 = 0 x 5 =⑤ 0 (00) i.e, Integer (5) = Product (⑤ 0)

In the cases 6 = 06 and 8 = 08, if we neglect ‘0’ before the product 06 and 08, we may get only the numbers 6 and 8. But when we multiply any integer by ‘0’, the number hidden (in the showing form) inside the ‘0’ or zeroes of the “zero product” before the original zero by which we multiply (multiplier) it is not easy to say that neglect this zero or zeroes before original ‘0’ unless no need of further operation.

To balance the digits of the numbers of both sides of non-zero integers of an equation, we suggest to divide both side by 1. Here we find, 5 = ⑤0 (00), the product of right hand side is zero and 5 (zero product). We need to balance the equation to find 5 = 5. In this situation, it is necessary to divide both side by ‘0’ instead of 1 as zero is lesser in value than 1 and it is not a natural number. So, we may consider that when the product is “zero product” then it is necessary to divide by ‘0’ to make it a non-zero integer. Considering this view, we find-

5 ÷ 0 =⑤ 0 ÷ 0

=> 5 = 5.0

=> 5 = 5

From the above study, we may consider that 5 ÷ 0 = 5.

Now, we consider any negative number, suppose, -12 and divide it by ‘0’ considering -12 / 0 = -12,
we get -12 = 0 x (-12) = -①②0

Dividing both side of the equation by ‘0’

$-12 \div 0 = \textcircled{-1}\textcircled{2}0 \div 0$

=> $-12 = -12.0$

=> $-12 = -12$ (withdrawing 0)

From the above observations, we may consider that any non-zero number divide by ‘0’ remain unchanged.

5. Second way to find n/0 = n (n = non zero number):-

When we divide 0 / 0 and 00 / 00, we get the quotient as .0 and .00 respectively. Applying the formula Numerator=Quotient x Denominator + Remainder, we get 0 = 0.0 and 00 = 00.00 respectively which we can write 0.0 = 0 and 00.00 = 00 (withdrawing point zero or zeroes). We have observed that when we multiply zero or zeroes by .0 (point zero) or **point zeroes lonely** then the point zero or zeroes become the decimal part whereas original zero or zeroes become the integral part of the product.

We have also observed in the above that

$1 \times (0 / 0) = \textcircled{1}\ 0 / 0 = 1.0$, so $1 \times (0 / 0) = 1 \times .0 = 1.0$

Which means when we multiply any non-zero integer by .0 (point zero) or by point zeroes lonely not being a decimal part of any other number it becomes the decimal part whereas non-zero integer becomes the integral part of the product.

Considering the rule, we may write 2.00 = 2 x (00 / 00) and 25.00 = 25 x (00 / 00). Now if we cancel 0 / 0 from 2 x (00 / 00) and 25 x (00 / 00), we get 2 x (0 / 0) and 25 x (0 / 0) respectively which means 2 x (0 / 0) = 2.0 and 25 x (0 / 0) = 25.0. After deep study of the result 2.0 and 25.0, we find that when there is a decimal part in a decimal number like 2.00 and 25.00 then if we divide it by ‘0’ (zero) then it goes decreases by one zero from the decimal part ‘0’ or zeroes and if we reverse the process i.e, if we multiply by 0 / 0 then it will create another ‘0’ (zero) on extreme right of the decimal part. It means when we multiply .0 (point zero) by .0 (point zero) we get .00 (point zero zero).

From the above discussion, we come to conclude that if any non-zero integer in decimal form divide by ‘0’ it decreases only one ‘0’ (zero) from the decimal part of this decimal number. Suppose, we want to divide the numbers 25.00 and -6.00 by ‘0’ then we get 25.00 ÷ 0 = 25.0 and -6.00 ÷ 0 = -6.0 respectively which are equal to 25 and -6.

So we may consider that any non-zero number divided by ‘0’ remain unchanged or **n / 0 = n**, where n = non-zero integer.

Observations-

1. 0^0 and 0/0 result ˙0 (point zero)
2. Any non-zero number divide by zero results the dividend as quotient i.e, **n / 0 = n**

Conclusion

In this article, we focus the natural creation of digits on products of all the basic digits, including zero, after multiplication. We know it is somewhere against the rule of present system but what is true, we cannot deny. We think, Mahavira was correct when he says that any (non-zero) number divide by zero remain unchanged. We hope our new way of thinking and our reasonable solution to the hidden mathematical mystery will help the mathematical world in future.

References

[1] Das S, A solution of the unsolved mathematical mystery divide by zero and zero to the power zero, International Journal of Mathematics trends and technology, 2020;66(1); 8-13.

[2] Das S, A new approach of finding squares, International Journal of Research and Review, 2019; 6 (3); 198-201.

[3] Das S, A new concept of finding cubes and also higher power on two digit numbers, Internal Journal of Research and Review, 2019; 6 (5); 323-326.

[4] Das S , multiplication of any large number with the help of a new series of Algebraic formulas, International Journal of Research and Review, 2019:6 (11): 323-326.

[5] Das S, a new concept of multiplication of any large number with the help of a new series of Algebraic formulas, Gelore International Journal of applied sciences and humanities,2019 : 3(4):24-29.

[6] Das S, A new approach of multiplication with verification, International Journal of Mathematics trends and technology, 2019; 65 (1); 31-36.