International Journal of Sciences: Basic and Applied Research (IJSBAR)

ISSN 2307-4531
(Print & Online)

http://gssrr.org/index.php?journal=JournalOfBasicAndApplied

Engineering in Mathematical Fallacy 4=5 and Needs How Many Time to Proof 4=4

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Abstract

A fallacy (also called sophism) is the use of invalid or otherwise faulty reasoning, or "wrong moves" in the construction of an argument [20]. A fallacious argument may be deceptive by appearing to be better than it really is. A mathematical argument is a sequence of statements and reasons given with the aim of demonstrating that a claim is true or false. Arguments containing informal fallacies may be formally valid, but still fallacious. An assumption or series of steps which is seemingly correct but contains a flawed argument is called a mathematical fallacy [2]. In proofing 4=5, some mathematicians claims the invention of the word "mathematical fallacy" and some mathematicians want more 365 years to proof 4=4.

Keyword: Mathematics; Mathematicians; Fallacy; Proof; Symbol.

1. Introduction

Basic Rules and Properties of Algebra [21,2,7]:

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Type of Equation	Description	Operation	Form	Examples
Standard	operation-left-side	addition	$a+b=c$	$4+6=10$
	operation-left-side	subtraction	$a-b=c$	$11-6=5$
	operation-left-side	multiplication	$a\times b=c$	$7\times 6=42$
	operation-left-side	division	$a\div b=c$	$25\div 5=5$
	operation-left-side	mixed	$a+b-c=d$	$(4+3)\times 2=14$
Nonstandard	operation-right-side	addition	$c=a+b$	$10=4+6$
	operation-right-side	subtraction	$c=a-b$	$5=11-6$
	operation-right-side	multiplication	$c=a\times b$	$42=7\times 6$
	operation-right-side	division	$c=a\div b$	$5=25\div 5$
	operation-right-side	mixed	$d=(c\div b)\times a$	$25=(10\div 2)\times 5$
	no-operation	none	$a=a$	$4=4$
	operations-both-sides	any combination of $+, -, \times, \div$	$a+b=c-d$	$4+3=2+5$
			$a-b=c-d$	$12\div 3=2\times 2$
			$a\times b=c\div d$	$9-3=24\div 4$

Figure 1

Algebra is a branch of mathematics dealing with symbols and the rules for manipulating those symbols. In elementary **algebra**, those symbols (today written as Latin and Greek letters) represent quantities without fixed values, known as variables [22,10].

1.1. What is an Algebraic Expression?

Many people interchangeably use algebraic expression and algebraic equations unaware that these terms are totally different. An algebraic is a mathematical phrase where two side of the phrase are connected by an equal sign (=). For example, 3x + 5 = 20 is an algebraic equation where 20 represents the right-hand side (RHS) and 3x +5 represents the left-hand side (LHS) of the equation [23,10]. On the other hand, an algebraic expression is a mathematical phrase where variables and constants are combined using the operational (+, -, × & ÷) symbols. An algebraic symbol lacks the equal (=) sign. For example, 10x + 63 and 5x – 3 are examples of algebraic expressions [24].

1.2. Let’s take a review of the terminologies used in an algebraic expression

A variable is a letter whose value is unknown to us. For example, x is our variable in the expression: 10x + 63. The coefficient is a numerical value used together with a variable. For example, 10 is the variable in the expression 10x + 63. A constant is a term which has a definite value. In this case, 63 is the constant in an algebraic expression, 10x + 63 [25,4].

1.3. There are several types of algebraic expressions but the main type includes [9,12]

- Monomial algebraic expression

This is a type of expression having only one term for example, 2x, $5x^2$, 3xy, etc.

- Binomial expression

An algebraic expression having two unlike terms, for example, 5y + 8, y+5, $6y^3 + 4$, etc.

- Polynomial expression

This is an algebraic expression with more than one term and with non -zero exponents of variables. An example of a polynomial expression is ab + b c + ca, etc [26].

1.4. Other types of algebraic expressions are [27]

- Numeric Expression:

A numerical expression only consists of numbers and operators. No variable is added in a numeric expression. Examples of numeric expressions are; 2+4, 5-1, 400+600, etc [8].

- Variable Expression:

This I an expression which contains variables alongside numbers, for example, 6x + y, 7xy+6, etc.

2. Why the term "Mathematical fallacy" occurs

Figure 2

It is normal to accept in mathematics that 1=2 is false and in general it can not be happened, otherwise including engineering every science will be meaningless upon which we are now staying on mathematics and in consequence invention are inventing and so on. But how can an engineer proved 1=2 or 4=5 is true [28]?

Assume,

2.1. Steps are the following [29]

1. $\alpha=\beta$
2. $\alpha\times\alpha=\beta\times\alpha$ (Multiply both side by α)
3. $\alpha2=\alpha\beta$
4. $\alpha2-\beta2=\alpha\beta-\beta2$ (Subtract both side by $\beta2$)
5. $(\alpha+\beta)(\alpha-\beta)=\beta(\alpha-\beta)$ (Since $a2-b2=(a+b)(a-b)$)
6. $(\alpha+\beta)(\alpha-\beta)=\beta(\alpha-\beta)$
7. $\alpha+\beta=\beta$
8. $\alpha+\alpha=\alpha$ (Since $\alpha=\beta$)
9. $2\alpha=\alpha$
10. $2\alpha=\alpha$
11. $2=1$

If we add 3 to both sides, the equation is as following:-

5=4 0r 4=5

[proved]

In the above proof, by the language of mathematics [9], how can this happen and it is knew that 2 is not equal to 1 in general, so somewhere the proof is wrong and the term “mathematical fallacy” occurs. They said if anyone looks at the 6th step, $(\alpha-\beta)$ is being cancelled by dividing $(\alpha-\beta)$ on both the sides is wrong. Let's see what they said:-

1. $\alpha=\beta$
2. $(\alpha-\beta)=0$

$$\frac{\alpha-\beta}{\alpha-\beta} \Longrightarrow \frac{0}{0} \Longrightarrow \boxed{\text{Undetermined}}$$

But after divisions if R.H.S of the “=” sign contains any value, then the divisions is legal in mathematical law [7,2,21].

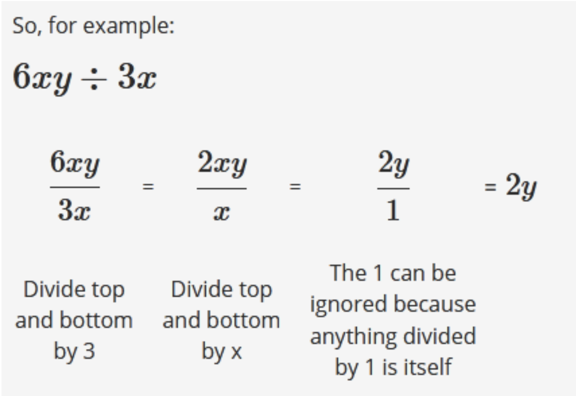

Figure 3

Look, same number division is legal [12].

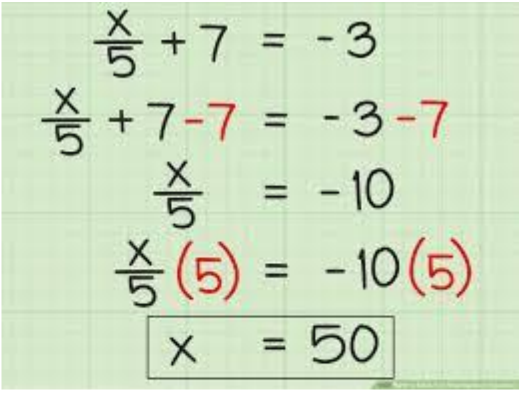

Figure 4

Look, same number subtraction is legal [13].

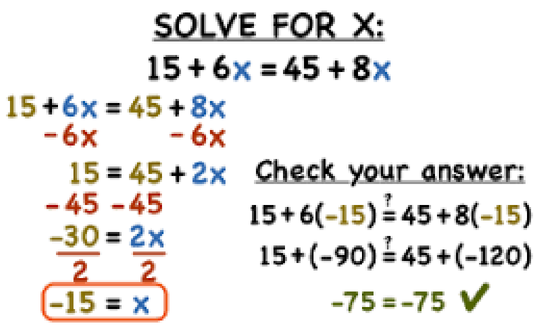

Figure 5

Look, this equation is not mathematical fallacy[17].

3. Case study[1]

If we go back step (1), where the assumption is α=β and by this assumption anyone can prove the equation 2=1 or 4=5, which is called mathematical fallacy in mathematics. Now the questions are if so then we have to consider the following situations [28,3]:

[Limitations in every Algebraic Equations as they can be proved that all LAWs are Fallacy]

<u>Consider One Algebraic law [28]:</u>

- ✓ $(a+b)^2 = a^2+b^2+2ab$
- ✓ $(a+b)^2 - a^2 - b^2 - 2ab = 0$

Divided both side with same value

$$\frac{(a+b)^2 - a^2 - b^2 - 2ab}{(a+b)^2 - a^2 - b^2 - 2ab} \longrightarrow \frac{0}{0} \longrightarrow \boxed{\text{Undetermined}}$$

<u>Now can tell:-</u>

a) we can not assume x=y or a=b or something= something never in life, and

b) we can not divided any number with the same number in the rest of our life [28].

But case **a),b)** is not true because every equation starts with an equal (=) sign in algebra [1,5].

4. Same type of some mathematical proves [16]

4.1. Can we do the followings or not [28]?

$$\begin{aligned}
1+1 &= 1+\sqrt{1} \\
&= 1+\sqrt{(-1).(-1)} \\
&= 1+\sqrt{(-1)}\times\sqrt{-1} && \sqrt{a.b}=\sqrt{a}\times\sqrt{b} \\
&= 1+i\times i && i=\sqrt{(-1)} \\
&= 1+i^2 \\
&= 1-1 && i^2=-1 \\
&= 0
\end{aligned}$$

Figure 6

If we add 2 in both sides the result will be following:-

<u>4=2</u>

Here if we assume (i>0), then the equation comes in true. Question is why?

4.2. Can we do the followings or not [28]?

Assume a, b >0

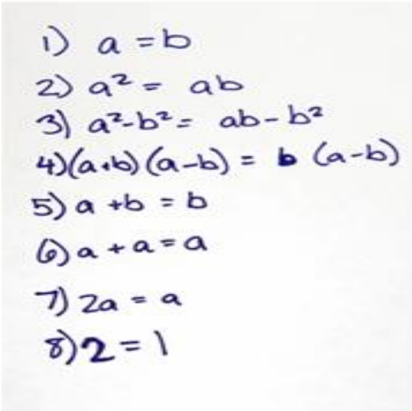

Figure 7

If we add 2 in both side the result will be following:

<u>4=3</u>

4.3. Can we do the followings or not [28]?

Assume a, b >0

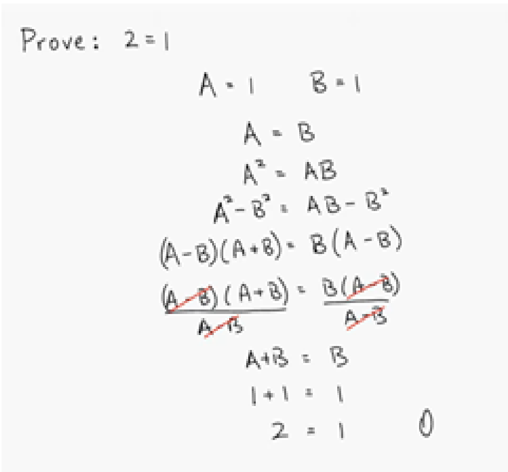

Figure 8

If we add 3 to both sides, the equation is as following:-

4=3

4.4. Can we do the followings or not [28]?

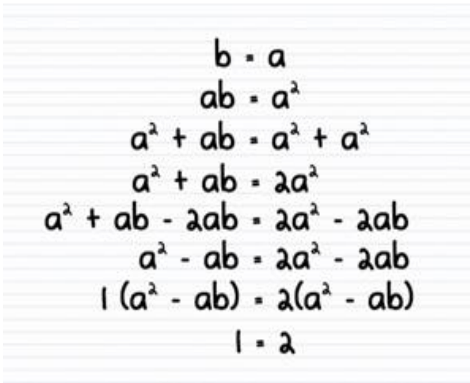

Figure 9

If we add 3 to both sides, the equation is as following:-

4=5

4.5. Can we do the followings or not [28]?

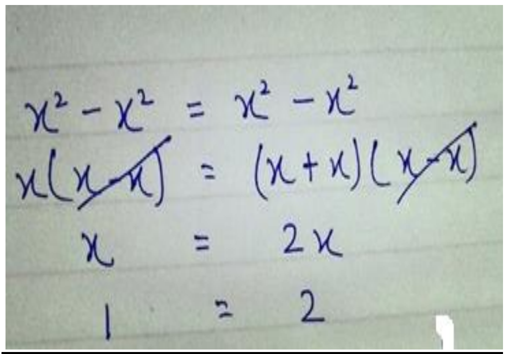

Figure 10

If we add 3 to both sides, the equation is as following:-

4=5

4.6. Can we do the followings or not [28]?

$$
\begin{aligned}
-1 &= -1 \\
-1/1 &= -1/1 \\
-1/1 &= 1/-1 \\
\sqrt{-1/1} &= \sqrt{1/-1} \\
i/1 &= 1/i \\
i &= 1/i \\
i^2 &= 1 \\
-1 &= 1
\end{aligned}
$$

Figure 11

If we add 5 to both sides, the equation is as following:-

<u>4=6</u>

Here 2 possibilities [A]:-in Left Hand Side of equal sign (+1)*(-1) or [B] in the Left Hand Side (-1)*(-1) = 1, if (+1)*(-1) means possibility [A] then the equation -1 = 1 comes true. Question is why?

5. Case study[2]

It can be proved that **4=2,3,5,6** but the fallacy talks nothing. Can anyone prove **4=4?** we can only write 4=4 as they looks same on both sides of equal sign [16,18,15].

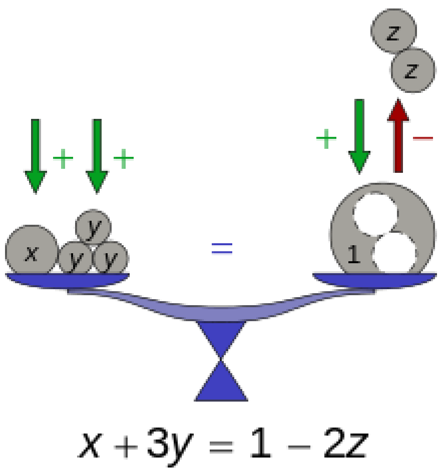

Figure 12

One is taken as a **symbol** equal to **"1"** here **'x'** in figure,**Two** is taken as a **symbol** equal to **"2"** here **'y'** in figure. Same for **"3","4","5","6"...etc.** They are only **symbols** just like **"1="i","2="ii","3="iii"…etc** in

Roman. If we introduce a new **symbol** equal to “One”, then “One” can be written to new **symbol**. Otherwise nobody can proof **4=4** in rest of the time of the world. All are just **symbols equal to symbols only [11].**

6. Conclusion

we have no mind set which allows mathematics has error. But it can be happened that error has in the way of equation as they can be expressed. It likes many puzzles exist more or less in every language’s folklore. This folklore did not turn the language false but just truly exists as like mathematical fallacy. And this is the final. Every mathematical fallacy have this two types of obstacle. One is Division matter - which we proved that it is right process, otherwise all Algebraic equations are also same fallacy. Another is (+,-) sign which appears from square root of any number or equation. But this two varieties can be compromised. There was no up to date references need to be included; especially because there was no previous related works.

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