

1 SECTION-14:

2 Dr. Math's (web site) **Incorrect** Explanations of why a $(-)(-)=(+)$

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4 From: <http://mathforum.org/dr.math/faq/faq.negxneg.html>

5
6 Broken-Symmetry (BS)Math – Symmetry-Math(SM)

7
8 The following are **INCORRECT** attempts by Dr. Math (DM) to
9 explain how a negative times a negative is equal to a positive.

10

11 **Negative x Negative = Positive**

12

13 *Minus times minus results in a plus, the reason for this, we*
14 *needn't discuss. - Ogden Nash*

15

16 Why does a negative times a negative equal a positive? People
17 have suggested many ways of picturing what is going on when a
18 negative number is multiplied by a negative number. It's not easy
19 to do, however, and there doesn't seem to be a visualization that
20 works for everyone.

21

22 **(DM)** Debt

23 Debt is a good example of a negative number. One common
24 form of debt is a mortgage in which you owe the bank money
25 because the bank paid for your house. It is also common for an
26 employer to deduct a mortgage payment from an employee's
27 paycheck to help the employee keep on schedule with the
28 payments.

29

30 Suppose \$700 is being deducted each month to pay the mortgage.
31 After six months, how much money has been taken out of the pay
32 for the mortgage? We can figure out the answer by doing
33 multiplication. $6 * -\$700 = -\$4,200$

34

35 **Jack Kuykendall (JK):** This is illogical nonsense. I do not owe a
36 negative \$4,200 to the mortgage company. I owe \$4,200 to the
37 mortgage company. I have just changed who owes and who
38 receives. Or I could tell the banker that I would like to pay the
39 sum I owe him squared and then he would owe me twice the
40 money I owe him (maybe I do like this kind of illogical math).

41

42 **(DM):** This is an illustration of a positive times a negative
43 resulting in a negative.

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45 **JK:** This is an illustration of making a definition fit whatever you
46 want it to mean.

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(DM): A Mathematical Explanation: If we can agree that a negative number is just a positive number multiplied by -1 , then we can always write the product of two negative numbers this way:

JK: This is where the problem exists. I **do not agree** that a negative number is just a positive number multiplied by -1 . You cannot multiply opposite directions or opposite signs.

(l)(l) = (l)(r) (l)(r) = (l)(l)(r)(r) = ? This is illogical

$(-a)(-b) = (-1)(a)(-1)(b) = (-1)(-1)ab$
(dir)(dir)

$(-a)$ and $(-b)$ are directions to the left of zero on the BS math number line. The dash sign $(-)$ cannot mean to subtract. This should be written:

$$\begin{pmatrix} \leftarrow \\ a \\ l \end{pmatrix} \begin{pmatrix} \leftarrow \\ b \\ l \end{pmatrix} = \begin{pmatrix} \leftarrow \\ l \end{pmatrix} \begin{pmatrix} \leftarrow \\ l \end{pmatrix} (a)(b)$$

(DM): For example,

$$\begin{aligned} -2 * -3 &= (-1)(2)(-1)(3) \\ &= (-1)(-1)(2)(3) \\ &= (-1)(-1) * 6 \end{aligned}$$

$$\begin{pmatrix} \leftarrow \\ 2 \\ l \end{pmatrix} \begin{pmatrix} \leftarrow \\ 3 \\ l \end{pmatrix} = \begin{pmatrix} \leftarrow \\ l \end{pmatrix} \begin{pmatrix} \leftarrow \\ l \end{pmatrix} (2)(3)$$

So the real question is, $(-1)(-1) = ?$ and the answer is that the following **convention** has been adopted: $(-1)(-1) = +1$

JK: a definition was established. It is **INCORRECT** and **ILLOGICAL**. As can be seen from SM this is unnecessary. The answer is 6 to the left.

(DM): This convention has been adopted for the simple reason that *any other convention would cause something to break*.

JK: Something does break. The BS math system is **BROKEN**. The distributive law needs modification. The answer is to eliminate negatives, positives and multiplication by directions.

(DM): For example, if we adopted the convention that $(-1)(-1) = -1$, the distributive property of multiplication wouldn't work for negative numbers:

$$\begin{aligned} (-1)(1 + -1) &= (-1)(1) + (-1)(-1) \\ (-1)(0) &= -1 + -1 \\ 0 &= -2 \end{aligned}$$

JK: Therefore, the distributive law is **INCORRECT** and needs **MODIFICATION**.

105 **(DM):** As Sherlock Holmes observed, "When you have excluded
 106 the impossible, whatever remains, however improbable, must be
 107 the truth."

108
 109 **JK:**
 110 1st: NO! This violates all of science.
 111 2nd: All possibilities were not considered. And, absolutely, all
 112 logical possibilities were not considered.

113
 114 $(\overset{\text{subtraction}}{-})(\overset{\text{subtraction}}{-}) = (\overset{\text{addition}}{+})$ A subtraction operator multiplied by a
 115 subtraction operator is equal to an addition operator. What is the
 116 meaning of multiplying subtraction operators? Clearly, this is
 117 illogical

118 $(\overset{\text{direction..left}}{\leftarrow})(\overset{\text{direction..left}}{\leftarrow}) = (\overset{\text{direction..right}}{\rightarrow})$ A direction to left multiplied by a
 119 direction to the left is equal to a direction to the right. Clearly,
 120 this is illogical.

121
 122 **SM LOGICAL:**

123 $(\overset{\text{subtraction of a direction}}{-})(\overset{\text{direction}}{\rightarrow}) = (\overset{\text{opposite direction}}{\leftarrow})$ The subtraction of a direction
 124 is the opposite direction. **LOGICAL**

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 126
$$\left[\begin{array}{l} \text{direction} \quad \text{direction} \quad \text{same direction} \\ (\overset{\rightarrow}{\rightarrow}) \& (\overset{\rightarrow}{\rightarrow}) = (\overset{\rightarrow}{\rightarrow}) \\ (r) \& (r) = (r) \end{array} \right]$$

127 A direction to the right added to a direction to the right is equal to
 128 a direction to the right.

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$$\left[\begin{array}{l} \text{direction} \quad \text{direction} \quad \text{same direction} \\ (\overset{\leftarrow}{\leftarrow}) \& (\overset{\leftarrow}{\leftarrow}) = (\overset{\leftarrow}{\leftarrow}) \\ (l) * (l) = (l) \end{array} \right]$$

131 A direction to the left added to a direction to the left is equal to a
 132 direction to the left.

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$$\left[\begin{array}{l} (\rightarrow)(\leftarrow) = ? \quad (\rightarrow)(\rightarrow) = ? \quad (\leftarrow)(\leftarrow) = ? \\ (r)(l) = ? \quad (r)(r) = ? \quad (l)(l) = ? \end{array} \right]$$

136 Clearly, this is **ILLOGICAL!** There is **NO** multiplication of
 137 direction in space.

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(DM): Since everything except +1 can be excluded as impossible, it follows that, however improbable it seems, $(-1)(-1) = +1$.

JK: Maybe it is Supernatural or the Devil did it. This is gross incorrect use of logic. Since I cannot explain something, it must be supernatural.

Number Line

(DM): Imagine a number line on which you walk. Multiplying $x*y$ is taking x steps, each of size y . Negative steps require you to face the negative end of the line before you start walking and negative step sizes are backward (i.e., heel first) steps. So, $-x*-y$ means to stand on zero, face in the negative direction, and then take x backward steps, each of size y .

JK: The BS math number line is the problem. There are NO negative directions or numbers and NO positive directions or numbers. There are just directions and numbers. I would like to see someone walk in a negative direction.

Patterns

(DM): Here's a plausibility argument drawn from multiplication patterns:

$$3 \times -3 = -9$$

JK: $(+)(3) \times (-)(3) =$ is not allowed. You cannot multiply a subtraction operator by and addition operator.

$$2 \times -3 = -6$$

$$1 \times -3 = -3$$

$$0 \times -3 = 0$$

$$-1 \times -3 = 3$$

JK: Again, you cannot multiply opposites

197

198 **A Proof**

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200 **(DM):** Let 'a' and 'b' be any two real numbers. Consider the
 201 number 'x' defined by

$$202 \quad x = ab + (-a)(b) + (-a)(-b).$$

203

204 **JK:** The dash sign is a direction in space. It is not a subtraction
 205 operator. The second term cannot be used. You cannot multiply
 206 opposite directions in space. The proof is based on an incorrect
 207 assumption and is, therefore, incorrect.

208

209 **(DM):** We can write

$$210 \quad x = ab + (-a)[(b) + (-b)] \quad (\text{factor out } -a)$$

$$211 \quad = ab + (-a)(0)$$

$$212 \quad = ab + 0$$

$$213 \quad = ab.$$

214 Also,

$$215 \quad x = [a + (-a)]b + (-a)(-b) \quad (\text{factor out } b)$$

$$216 \quad = 0 * b + (-a)(-b)$$

$$217 \quad = 0 + (-a)(-b)$$

$$218 \quad = (-a)(-b).$$

219 So we have

$$220 \quad x = ab$$

221 and

$$222 \quad x = (-a)(-b)$$

223

224 Hence, by the transitivity of equality, we have

$$225 \quad ab = (-a)(-b).$$

226

227 **JK:** Every mathematician should have discovered the problem
 228 when they arrived at this answer; opposites are equal. This is
 229 nonsense and mathematically illogical.