

Math Myths and Misconceptions **Counter-examples for Facilitator**

To the Session Facilitator: The counter-examples and information given below is intended to be background information for you. Session participants should be given the opportunity to come up with similar examples themselves rather than these examples being given to them. All of these misconceptions deal with having learned or been told about a procedure for a limited set of numbers rather than understanding the larger mathematical concept of numbers (integers, fractions, and decimals.) as well as what is happening operationally.

Note: Formatted to 8 ½ x 14 layout

Misconception	“Limited Truth” Examples	Counter-example and how it might look	Impact on future learning
<p>“You can’t take a bigger number from a smaller number.”</p>	<p>True only if you plan to stay within the positive whole numbers (greater than zero):</p> $6 - 9 < 0 \text{ or } -3$	<p>Full understanding of number:</p> $6 - 9 = -3$	<p>Most young children do understand the concept of “owing.” You can take 9 from 6, but you now “owe” 3 or have -3. As children move on in their mathematical learning, they will be encountering negative integers, beginning in 4th grade. When we use the “limited truth” language, it can cause confusion and misunderstanding of number in later mathematics learning as well as their overall number sense.</p>
<p>“When you multiply two numbers together, the answer is always bigger than both of the original numbers.”</p>	<p>True when multiplying positive whole numbers:</p> $6 \times 8 = 48$ <p>True when multiplying two negative whole numbers:</p> $-2 \times -3 = 6$	<p>Not true when:</p> <p>Multiplying with fractions:</p> $\frac{1}{2} \times 9 = 4.5$ $\frac{1}{4} \times \frac{3}{4} = \frac{3}{16}$ <p>Multiplying with decimals:</p> $.03 \times 25 = .75$ $0.6 \times 0.7 = .42$ <p>Multiplying a negative and a positive number:</p> $-4 \times 5 = -20$ <p>Multiplying with 0 or 1:</p> $17 \times 0 = 0$ $1 \times 42 = 42$	<p>As seen in the counter-examples, the “always gets bigger” does not hold true for multiplication with fractions or decimals, a concept introduced currently in 5th grade. Additionally, it does not hold true when multiplying a negative and a positive number. Again, when we use the “limited truth” language, it can cause confusion and misunderstanding of number in later mathematics learning. This is a significant issue as children move into concepts of operations with fractions beginning in 5th grade.</p>
<p>“To multiply by 10, just add a zero to the end of the number.”</p>	<p>True when multiplying positive whole numbers:</p> $5 \times 10 = 50$	<p>Not true when:</p> <p>Multiplying with decimals:</p> $23.7 \times 10 \neq 23.70$ <p>Multiplying with fractions:</p> $\frac{2}{3} \times 10 \neq \frac{20}{30} \text{ or } \frac{2}{30}$	<p>The concept of multiplying by ten is a significant piece in understanding our base-ten system. The “limited truth” language does not give an indication of the change in place value which is what’s actually happening. It becomes additionally confusing for students beginning in 5th grade as they start multiplication with decimals and fractions.</p>