Grade 6: Expression

6.EE.A.2 - Write, read, and evaluate expressions in which letters stand for numbers.

If $c = 1.7$, what is the value of $0.97c + 0.03c - c$?

Idea: simplify the expression first.

Answer: ☐

Solution

Correct if student writes 0.

Answer: 0. The long way to find this answer is by first calculating the product $0.97 \times 1.7 = 1.649$, next calculating the product $0.03 \times 1.7 = 0.051$, and finally calculating the sum $1.649 + 0.051 - 1 = 0$.

It is easy to make a mistake using that approach, even with a calculator. As suggested by the hint, a better approach is to simplify the expression first.

There is an opportunity to combine the three terms. We can combine the terms in pairs: first add $0.97c$ to $0.03c$, and then subtract c from that result:

$0.97c + 0.03c$

$= (0.97 + 0.03)c$

$= (1.00)c$

$= c$

and

$c - c = 0$.

The value of the expression is zero for any value of *c*.

If the student is having a hard time simplifying the expression, try helping them apply what they know about how numbers work. For example, we could read "0.97*c*" as "ninety-seven hundredths of something." When we add three more hundredths of the thing, the result is a hundred hundredths of the thing, or a whole thing (1). Subtract from this the amount itself, and the net result is zero.

If talking about "something" seems too abstract, then try thinking of *c* as standing for something more concrete, like an inch. Then we could read "0.97*c*" as "ninety-seven hundredths of an inch." When we add three more hundredths of an inch, the result is a hundred hundredths of an inch, or 1 inch. Finally, subtract 1 inch and the net result is zero.

Another way to work is to use the distributive property to collect all three coefficients together in one step:

$0.97c + 0.03c - c$

$= (0.97 + 0.03 - 1)c$

$= (1.00 - 1)c$

$= (0)c$

$= 0.$

Elaboration on Alignment

This problem is a middle-school version of a high-school level problem by Tony Gardiner that was included as problem #11 under *Expressions* in the example tasks published alongside the 2009 *College and Career Readiness Standards*.

TIMSS data, as analyzed by Kilpatrick and others, would seem to suggest that students in the U.S. are well drilled on the skill of substituting values into variable expressions. In this problem, it is advantageous to override the routine procedure and rewrite the expression *before* substituting values.

The coefficients 0.97 and 0.03 are easy to add mentally, and they are intended to flag the attention in a way that suggests addition. The hint is intended to ensure that fledgling algebraists have an opportunity to try algebra first, rather than diving in and carrying out a series of multi-digit computations.

The multi-digit arithmetical skills that students have acquired in their schooling up through grade 6 are essential to quantitative literacy and problem-solving power. However, beginning in grade 6, the specifics of the place-value format become markedly less important as students begin using the format-independent properties of operations to work with "general numbers" (variables). Grade 6 is a pivotal year in the evolution of arithmetic into algebra. To the extent that format continues to be important in algebra, the key format isn't the multi-digit place value scheme; it's the fraction format $\frac{\&}{\&}$ used for quotients in numerical and algebraic rational expressions such as $-\frac{1}{3}$, $\frac{d}{t}$, $\frac{\Delta y}{\Delta x}$, or $\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$.

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Name: _____

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