TAKE IT TO THE MAT

A NEWSLETTER ADDRESSING THE FINER POINTS OF MATHEMATICS INSTRUCTION

Math Audit Team
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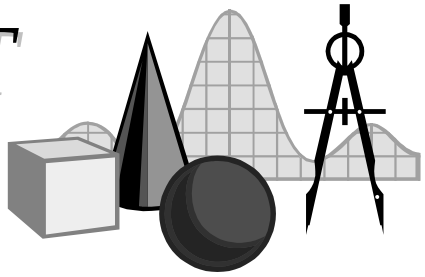

Solving equations is an integral component of the middle school curriculum. Students must have the ability to find the value of unknowns in various situations. By fifth grade, most students have an awareness of order of operations. In this issue of *Take It to the MAT*, we will concentrate on the solving of simple *linear equations* and its link to the previously learned *order of operations*.

Think about how to evaluate the expression $6 + 3 \times 4$. We know from order of operations that we first multiply 3 and 4 to get 12, then add 6 and 12 for the final answer of 18.

Now consider evaluating $6 + 3x$ for $x = 4$. Substituting, we can rewrite this as $6 + 3(4)$. Again, we *multiply* 4 by 3 followed by the *addition* of 6. By order of operations, the result is still the same, 18.

Evaluate: $6 + 3x$ for $x = 4$

$6 + 3\mathbf{x}$

$6 + 3 \cdot \mathbf{4}$ ① Multiply by 3

$6 + \mathbf{12}$ ② Add 6

$\mathbf{18}$

Shift gears now to the solving of equations. How do we teach students to solve the equation $6 + 3x = 18$ for x? Yes, *subtract* 6 from both sides of the equation, yielding $3x = 12$. Then, *divide* both sides by 3 giving $x = 4$.

Solve: $6 + 3x = 18$

$6 + 3x = 18$

$6 + 3x - 6 = 18 - 6$ ① Subtract 6

$3x = 12$

$\frac{3x}{3} = \frac{12}{3}$ ② Divide by 3

$x = 4$

Compare the steps from evaluating the expression $6 + 3x$ for $x = 4$ to the steps for solving the equation $6 + 3x = 18$. They are precisely the inverse operations in the opposite order! In the first case, we *multiply* then *add*; in the second case, we *subtract* then *divide*. See illustrations at right.

Now, take a look at these:

Evaluate: $\frac{\mathbf{x}}{4} - 7$ for $x = -8$

$\frac{\mathbf{x}}{4} - 7$

$\frac{\mathbf{-8}}{4} - 7$ ① Divide by 4

$\mathbf{-2} - 7$ ② Subtract 7

$\mathbf{-9}$

Solve: $\frac{x}{4} - 7 = -9$

$\frac{x}{4} - 7 + 7 = -9 + 7$ ① Add 7 (inverse of subtraction)

$\frac{x}{4} = -2$

$\frac{x}{4} \cdot 4 = -2 \cdot 4$ ② Multiply by 4 (inverse of division)

$x = -8$

Again, the difference between evaluating the expression and solving the equation is doing the inverse operations in the opposite order. Many times students forget what to do when solving equations. The connection between traditional equation-solving procedures and the order operations is strong. Students usually get order of operations down fairly well using mnemonics like "Please Excuse My Dear Aunt Sally"; linking this to equation solving is a very powerful tool in building a student's repertoire of skills.