

# Algebra,

*Been there – Done that*

## Linear Equations

### *Mathematical Systems*

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Algebra, Been there –Done that is a newsletter that links algebra to previously learned concepts and skills or outside experiences

Kids began solving simple equations when they worked missing addends problems in first and second grades. They were given problems such as  $4 + n = 6$  and had to find the value of  $n$  by guessing and substituting numbers to find one that worked.

General Form of a  
Linear Equation

$$ax + b = c$$

As students learned to evaluate arithmetic expressions in mathematics, they were taught the Order of Operations. The Order of Operations, an agreement that allows us to evaluate arithmetic expressions, also serves as the foundation for solving linear equations.

To evaluate an expression such as;  $4 + 2 \times 5$ , we'd use the Order of Operations.

#### **Order of Operations**

1. Grouping
2. Exponentials
3. Multiply/Divide
4. Addition/Subtraction

Strategy to solve  
equations:

Using that agreement, we find that  $4 + 2 \times 5 = 14$ .

Use the  
Order of Operations  
in reverse to undo  
expression.

Now, if I asked students to solve  $2x + 4 = 14$ , they would have to find the value of  $x$  that makes that open sentence true. To find the value of  $x$ , they would have to undo the expression on the left to isolate the  $x$ .

Think of Gift  
Wrapping analogy.

Before we do that, let's look at a gift wrapping analogy. If I were to give you a present, I would put in a box, put the cover on the box, put paper on the box, tape it, and place a ribbon on it. For you to get the present out of the box, you would take the ribbon off, take the tape off, remove the paper, take the top off, and take the present out. In other words, you would do exactly opposite of what I did to give you the present.

When problems get  
longer and include  
parentheses,  
fractions, etc, use the  
Properties of real  
Numbers to get rid  
of the them and  
make the problem  
look like  $ax + b = c$ .

We do the same to solve an equation. The way we arrived at  $4 + 2 \times 5 = 14$  was using the Order of Operations. For us to solve an equation, undo an algebraic expression, we need to use the Order of Operations in reverse using the opposite operation to undo the expression.

To solve  $2x + 4 = 14$ , we need to get rid of any addition or subtraction. Since we have an addition, we'll do the opposite and subtract. That leaves us with  $2x = 10$ .

Continuing to use the Order of Operation in reverse, we need to get rid of any multiplication or division. We have a multiplication by 2, so to get rid of the multiplication we divide, the answer, the solution, the value of the variable that makes the open sentence true is 5.

Solving equations  
can not get harder,  
problems can only  
get longer.

In general, we were solving equations written in the form,  $ax + b = c$ .

When more is added to an equation, such as parentheses or fractions, students should get rid of those by one of the Properties of Real Numbers, then rewrite the equation in  $ax + b = c$  form. In that way, all linear equations can be solved using the Order of Operations strategy.