**A Short Introduction to the New Math**

Many who have been out of school for a number of years find, If they want to refresh their knowledge of mathematics, that there has been a great change, a sort of mathematical revolution while they were away from school. The old, classical math has had its face lifted and has taken on a new look which modern instructors claim is a great improvement.

In the classical math often taught in high-school courses, many simple truths were taken for granted and there was a failure to analyze these truths to find out why they are true and under what particular conditions they might not be true.

During the past centuries, great, world-shaking theories were born, notably the Maxwell electromagnetic theory, the theory of relativity, and the concept of differential and integral calculus. And all these extremely important doctrines came about as a result of questioning and continually asking WHY?

The results obtained using the New Math agree, of course, with those obtained using the old, classical math, but the method of the former is much more thorough and therefore more satisfactory to the student who has never before studied math. The New Math teaches a student to think a problem through rather than try to recall tricks of manipulation.

Let's take a simple example of the two methods:

We all learned that if *x2* − 4 = 0, *x* must equal either 2 or −2. Either of these numerical replacements for the letter *x* makes the statement meaningful. This is so elementary it hardly needs comment. But just how did we arrive at this ±2? Did we actually «transpose» the −4 to the other side of the equal sign where it became +4, the equation becoming x2 = 4 and *x* becoming ±2? Any child might well ask, «Why do we change signs when we «transpose» from one side to the other in an equation». This, of course, is a sensible question. In the New Math this is dealt with before the child asks the question. We say:

If *x2* − 4 = 0, then by adding +4 to both sides of the equation we get *x2* − 4 + 4 = 0 + 4.

Next we show that −4 and +4 cancel each other and that 0+4 = 4. Then *x2*+0 = 4 or *x2*=+4. Thus *x=±2.*

As a matter of fact, it is not at all difficult to demonstrate that we solved our little problem by making use of some of the eleven laws that form the foundation of arithmetic. Yes, that is a truly startling fact – and a truly startling discovery. Numbers are one of the most basic of the great ideas of mathematics. And believe it or not, eleven laws – not an infinity of manipulative devices – are the tools available to us when we want to solve problems. These are the eleven laws of real numbers:

1. *The Closure Law of Addition.* The sum of any two real numbers is a unique real number. For example, the sum of 10 and 117 is 127.
2. *The Commutative Law of Addition.* The order in which we add is trivial. For example, the sum of 3 and 4 is 7; the sum of 4 and 3 is also 7.
3. *The Associative Law of Addition.* Since addition is defined for pairs of numbers, the addition of three numbers depends on our first adding any two of the numbers and then adding their sum to the third number; the order in which we do this is trivial. For example, when 3, 4 and 5 are added in three different orders, the same sum is obtained:

3+4 = 7, 7+5 = 12

4+5 = 9, 9+3 = 12

3+5 = 8, 8+4 = 12

1. *The Identity Law for Addition.* The number zero is the additive identity, for the addition of it to any other number leaves the second number unchanged. For example, the sum of 0 and 9 is 9.
2. *The Inverse Law for Addition.* The sum of any number and its negative is zero. For example, the sum of 5 and –5 is 0.
3. *The Closure Law for Multiplication.* The product of any two-real numbers is a unique real number. For example, the product of 117 and 10 is 1,170.
4. *The Commutative Law of Multiplication.* The order in which we multiply is trivial. For example, the product of 3 and 4 is the same as the product of 4 and 3.
5. *The Associative Law of Multiplication.* Since multiplication is defined for pairs of numbers, the multiplication of three numbers depends on our first multiplying two of the numbers and then multiplying their product by the third number; the order in which we do this is trivial. For example:

3  4 = 12, 12  5 = 60

3  5 = 15, 15  4 = 60

4  5 = 20, 20  3 = 60

9. *The Identity Law for Multiplication.* The number one is the multiplicative identity, for the product of it and any other number leaves the second number unchanged. For example, the product of 1 and 8 is 8.

1. *The Inverse Law for Multiplication.* The product of any number (except zero) and its reciprocal is one. For example, the product of 3 and  is 1; the product of 5 and  is 1; the product of and  is 1. Division of a number by zero is meaningless.
2. *The Distributive Law.* Multiplication «distributes» across addition. For example:

6  (4 + 5) = 6  9 = 54

6  (4 + 5) = (6  4) + (6  5) = 24 + 30 = 54