NONRESIDENT
TRAINING
COURSE

Mathematics, Basic Math and Algebra

NAVEDTRA 14139

PREFACE

About this course:

This is a self-study course. By studying this course, you can improve your professional/military knowledge, as well as prepare for the Navywide advancement-in-rate examination. It contains subject matter supporting day-to-day occupational knowledge and skill requirements and includes text, tables, and illustrations to help you understand the information.

Any errata for this course can be found at https://www.advancement.cnet.navy.mil under Products.

History of the course:

- *June 1980: Original edition released.*
- *June 1985: Reprinted.*
- *Apr 2003: Administrative update released. Technical content was not reviewed or revised.*

NOTE

In the assignment portion of this course, a question with no answer choices given is a True/False question. For True/False questions, answer 1 for True and 2 for False.

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CHAPTER 1
NUMBER SYSTEMS AND SETS

Mathematics is a basic tool. Some use of mathematics is found in every rating in the Navy, from the simple arithmetic of counting for inventory purposes to the complicated equations encountered in computer and engineering work. Storekeepers need mathematical computation in their bookkeeping. Damage Controlmen need mathematics to compute stress, centers of gravity, and maximum permissible roll. Electronics principles are frequently stated by means of mathematical formulas. Navigation and engineering also use mathematics to a great extent. As maritime warfare becomes more and more complex, mathematics achieves ever increasing importance as an essential tool.

From the point of view of the individual there are many incentives for learning the subject. Mathematics better equips him to do his present job. It will help him in attaining promotions and the corresponding pay increases. Statistically it has been found that one of the best indicators of a man's potential success as a naval officer is his understanding of mathematics.

This training course begins with the basic facts of arithmetic and continues through some of the early stages of algebra. An attempt is made throughout to give an understanding of why the rules of mathematics are true. This is done because it is felt that rules are easier to learn and remember if the ideas that led to their development are understood.

Many of us have areas in our mathematics background that are hazy, barely understood, or troublesome. Thus, while it may at first seem beneath your dignity to read chapters on fundamental arithmetic, these basic concepts may be just the spots where your difficulties lie. These chapters attempt to treat the subject on an adult level that will be interesting and informative.

COUNTING

Counting is such a basic and natural process that we rarely stop to think about it. The process is based on the idea of ONE-TO-ONE CORRESPONDENCE, which is easily demonstrated by using the fingers. When children count on their fingers, they are placing each finger in one-to-one correspondence with one of the objects being counted. Having outgrown finger counting, we use numerals.

NUMERALS

Numerals are number symbols. One of the simplest numeral systems is the Roman numeral system, in which tally marks are used to represent the objects being counted. Roman numerals appear to be a refinement of the tally method still in use today. By this method, one makes short vertical marks until a total of four is reached; when the fifth tally is counted, a diagonal mark is drawn through the first four marks. Grouping by fives in this way is reminiscent of the Roman numeral system, in which the multiples of five are represented by special symbols.

A number may have many "names." For example, the number 6 may be indicated by any of the following symbols: $9 - 3$, $12/2$, $5 + 1$, or 2×3. The important thing to remember is that a number is an idea; various symbols used to indicate a number are merely different ways of expressing the same idea.

POSITIVE WHOLE NUMBERS

The numbers which are used for counting in our number system are sometimes called natural numbers. They are the positive whole numbers, or to use the more precise mathematical term, positive INTEGERS. The Arabic numerals from 0 through 9 are called digits, and an integer may have any number of digits. For example, 5, 32, and 7,049 are all integers. The number of digits in an integer indicates its rank; that is, whether it is "in the hundreds," "in the thousands," etc. The idea of ranking numbers in terms of tens, hundreds, thousands, etc., is based on the PLACE VALUE concept.

PLACE VALUE

Although a system such as the Roman numeral system is adequate for recording the