



I.1 Fundamentals of Measurement and Calculation

GOAL To provide a review of basic math concepts.

.....

.....

OBJECTIVES

This chapter equips students to:

- Identify types of numbers: whole, fraction, mixed, and denominate
 - Interconvert Arabic and Roman numerals
 - Define proper and improper fractions
 - Interconvert improper fractions and mixed numbers and reduce fractions to lowest terms
 - Calculate the lowest common denominator for multiple fractions
 - Interconvert common fractions, decimal fractions, and percentages
 - Calculate using exponential forms of numbers
 - Solve problems using addition, subtraction, multiplication, and division of numbers, fractions, decimals, percentages and exponentials
-

KEYWORDS

Addition
Arabic numeral
Common fraction
Decimal fraction
Denominate number
Division
Exponential notation
Mixed number
Multiplication
Percentage
Roman numeral
Subtraction
Whole number

Importance for Medical Math and Clinical Practice

The study of numbers is the oldest part of modern mathematics, having its origin in prehistory with the etching of marks onto stone or bone to indicate a quantity of objects. It is an elementary part of arithmetic—which is part of number theory, which, itself, is but one division of modern mathematics. More specifically, the word *arithmetic* describes operations done with numbers such as addition, subtraction, multiplication, and division. The word *number* denotes an abstract value because by itself it has no context. Alone, a number does not tell us what is described, only the quantity of what is described. A number, to be useful in medical math, must always be tied directly to what it describes. The number must be a *denominate (concrete)* number that has both a numeric value (for example, 29.6) and the units described (for example, milliliters of water; therefore, 29.6 milliliters of water).

The Romans used a system of numbers that focused on concrete objects because the Roman system of numerals has neither negative numbers nor a zero digit. The Romans did not concern themselves with the number line of modern math that has a zero point and negative numbers (numbers on the number line to the left of the zero point). The Roman system was supplanted by the modern system of Arabic numerals, which does consider zero and negative numbers. The Arabic system has lent itself nicely to the development of the complex mathematics used today in science and engineering. Arabic numerals are the major focus of this chapter and modern medical math. Roman numerals and the interconversion of Roman numerals and Arabic numerals are studied only briefly in this

chapter because, although rare, reference to objects by Roman numerals is still used by some healthcare practitioners.

One of the most important lessons for students of medical math is to always include the units of measure associated with the numerals (numbers, digits) used in a calculation problem. The usual reason students fail to do this is that although the operations performed (addition, subtractions, multiplication, division, etc.) are very familiar to students, the objects/units of a medical math problem are not. **Don't forget to perform each calculation step in the problem's solution by always including the relevant units of measurement.** Possibly the most embarrassing time for an individual working in health-care occurs during attendance at a life-saving procedure for a patient. Often referred to as "codes" (cardiopulmonary resuscitation emergencies), this setting requires the rapid administration of drugs. Always having in mind both the number and units resulting from a quick calculation needed during the code can significantly reduce errors in dosing and the tension present during codes.

Study the entire contents of Chapter 1 as a refresher of your skills. The examples should provide adequate practice for you. Pay particular attention to the ideas of place holding illustrated by the sections on decimals and percentages. A very common mistake doing medical math calculations is the failure to recognize that a problem's answer displayed on a calculator screen is incorrect by a factor of 10 or 100 or one-tenth or one-hundredth. Practicing the correct placement of a decimal point in an answer will help you develop the habit of intuitively checking the magnitude of an answer. That is, you will begin to estimate the size of an answer in your head. This intuitive style of estimating an answer is an extremely helpful habit for you to form. Also, pay particular attention to the interconversion of decimals and percentages. Realize that 1% is 0.01, noting that the percent sign (%) itself immediately focuses your attention to the hundredths place in the decimal form of a percentage.

.....
Numbers and Numerals

- **Number:** a total quantity of objects.
 - **Whole number** (abstract number): taken by itself with no units of measure.
 - **Example:** 4
 - **Fraction:** a portion of a whole number; contains a *numerator* (top number) and a *denominator* (bottom number).
 - **Example:** $\frac{5}{8}$
 - **Mixed number:** consists of a whole number plus a fraction.
 - **Example:** $2\frac{5}{8}$
 - **Denominate number:** designates the total quantity and units of measure for whatever has been measured.
 - **Example:** 12 grams