= 3 + ½ =
3 @.@ 5 .
This notation can cause confusion since in most other contexts juxtaposition denotes multiplication instead .
The sum of a series of related numbers can be expressed through capital sigma notation , which compactly denotes iteration . For example ,
<formula>
The numbers or the objects to be added in general addition are collectively referred to as the terms , the addends or the summands ; this terminology carries over to the summation of multiple terms . This is to be distinguished from factors , which are multiplied . Some authors call the first addend the augend . In fact , during the Renaissance , many authors did not consider the first addend an " addend " at all . Today , due to the commutative property of addition , " augend " is rarely used , and both terms are generally called addends .
All of the above terminology derives from Latin . " Addition " and " add " are English words derived from the Latin verb addere , which is in turn a compound of ad " to " and dare " to give " , from the Proto @-@ Indo @-@ European root * deh ? - " to give " ; thus to add is to give to . Using the gerundive suffix -nd results in " addend " , " thing to be added " . Likewise from augere " to increase " , one gets " augend " , " thing to be increased " .
" Sum " and " summand " derive from the Latin noun summa " the highest , the top " and associated verb summare . This is appropriate not only because the sum of two positive numbers is greater than either , but because it was common for the ancient Greeks and Romans to add upward , contrary to the modern practice of adding downward , so that a sum was literally higher than the addends . Addere and summare date back at least to Boethius , if not to earlier Roman writers such as Vitruvius and Frontinus ; Boethius also used several other terms for the addition operation . The later Middle English terms " adden " and " adding " were popularized by Chaucer .
The plus sign " + " (Unicode : U + 002B ; ASCII : & # 43 ;) is an abbreviation of the Latin word et , meaning " and " . It appears in mathematical works dating back to at least 1489 .

= = Interpretations = =

Addition is used to model countless physical processes . Even for the simple case of adding natural numbers , there are many possible interpretations and even more visual representations .

= = = Combining sets = = =

Possibly the most fundamental interpretation of addition lies in combining sets :
When two or more disjoint collections are combined into a single collection , the number of objects in the single collection is the sum of the number of objects in the original collections .
This interpretation is easy to visualize , with little danger of ambiguity . It is also useful in higher mathematics ; for the rigorous definition it inspires , see Natural numbers below . However , it is not obvious how one should extend this version of addition to include fractional numbers or negative numbers .
One possible fix is to consider collections of objects that can be easily divided , such as pies or , still better , segmented rods . Rather than just combining collections of segments , rods can be joined end @-@ to @-@ end , which illustrates another conception of addition : adding not the rods but the lengths of the rods .

= = = Extending a length = = =

A second interpretation of addition comes from extending an initial length by a given length :
When an original length is extended by a given amount , the final length is the sum of the original length and the length of the extension .
The sum a + b can be interpreted as a binary operation that combines a and b , in an algebraic

sense , or it can be interpreted as the addition of b more units to a . Under the latter interpretation , the parts of a sum a + b play asymmetric roles , and the operation a + b is viewed as applying the unary operation + b to a . Instead of calling both a and b addends , it is more appropriate to call a the augend in this case , since a plays a passive role . The unary view is also useful when discussing subtraction , because each unary addition operation has an inverse unary subtraction operation , and vice versa .

= = Properties = =

= = = Commutativity = = =

Addition is commutative : one can change the order of the terms in a sum , and the result is the same . Symbolically , if a and b are any two numbers , then

$a + b = b + a$.

The fact that addition is commutative is known as the " commutative law of addition " . This phrase suggests that there are other commutative laws : for example , there is a commutative law of multiplication . However , many binary operations are not commutative , such as subtraction and division , so it is misleading to speak of an unqualified " commutative law " .

= = = Associativity = = =

Addition is associative : when adding three or more numbers , the order of operations does not matter .