

Standard Algorithms in the Common Core State Standards

Developing and Understanding the Standard Algorithms In the Common Core State Standards

The standard algorithm for each of the operations of addition, subtraction, multiplication, and division are important for efficiency, mathematical understanding, and preparation for algebra and beyond. Sometimes misunderstood as purely mindless procedures to be followed, these algorithms utilize and reinforce a broad array of prior conceptual and procedural knowledge. The use of algorithms, on whatever level, must be accompanied by the understanding of how the algorithm works, not just what it accomplishes.

Section A presents the four Common Core State Standards that explicitly require the fluent use of the standard algorithms for addition, subtraction, multiplication, and division. Below the standard algorithm standards are examples showing a problem worked using the respective standard algorithm.

Section B presents the Common Core State Standards that lead to the development of the standard algorithms for addition, subtraction, multiplication, and division.

Section A

Addition and Subtraction

Grade 4 Fluently add and subtract multi-digit whole numbers using the standard algorithm.
4.NBT.4

Addition

$$\begin{array}{r} 11 \\ 673 \\ + 457 \\ \hline 1130 \end{array}$$

Subtraction

$$\begin{array}{r} 5 \\ 4,760 \\ - 326 \\ \hline 4,434 \end{array}$$

Multiplication and Division

Grade 5 Fluently multiply multi-digit whole numbers using the standard algorithm.
5.NBT.5

Grade 6 Fluently divide multi-digit numbers using the standard algorithm.
6.NS.2

Multiplication

$$\begin{array}{r} 5 \\ 41 \\ 346 \\ \times 92 \\ \hline 692 \\ 31140 \\ \hline 31,832 \end{array}$$

Division

$$\begin{array}{r} 23 \text{ r}8 \\ 64 \overline{) 1480} \\ \underline{- 128} \\ 200 \\ \underline{- 192} \\ 8 \end{array}$$

Result = 23 r8, or $23 \frac{8}{64}$, or $23 \frac{1}{8}$

Addition and Subtraction with Decimals

Grade 6
6.NS.3 Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.

Addition
w/decimals

$$\begin{array}{r} 1 \\ 0.74 \\ + 0.80 \\ \hline 1.54 \end{array}$$

Subtraction
w/decimals

$$\begin{array}{r} 8 \overset{1}{3} \\ 39.\overset{4}{4}\overset{6}{6} \\ - 20.89 \\ \hline 18.57 \end{array}$$

Multiplication and Division with Decimals

Grade 6
6.NS.3 Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.

Multiplication
w/decimals

$$\begin{array}{r} 0.482 \quad 3 \text{ decimal places} \\ \times 6.3 \quad 1 \text{ decimal place} \\ \hline 1446 \\ 28920 \\ \hline 3.0366 \quad 4 \text{ decimal places} \end{array}$$

Division
w/decimals

$$\begin{array}{r} 21.3 \\ \overline{) 13.632} \\ - 128 \\ \hline 83 \\ - 64 \\ \hline 192 \\ - 192 \\ \hline 0 \end{array}$$

Section B

Grade Level	Addition and Subtraction
K K.OA.4	For any number from 1 to 9, find the number that makes 10 when added to the given number, e.g., by using objects or drawings, and record the answer with a drawing or equation.
K K.NBT.1	Compose and decompose numbers from 11 to 19 into ten ones and some further ones, e.g., by using objects or drawings, and record each composition or decomposition by a drawing or equation (such as $18 = 10 + 8$); understand that these numbers are composed of ten ones and one, two, three, four, five, six, seven, eight, or nine ones.
1 1.OA.6	Add and subtract within 20, demonstrating fluency for addition and subtraction within 10. Use strategies such as counting on; making ten (e.g., $8 + 6 = 8 + 2 + 4 = 10 + 4 = 14$); decomposing a number leading to a ten (e.g., $13 - 4 = 13 - 3 - 1 = 10 - 1 = 9$); using the relationship between addition and subtraction (e.g., knowing that $8 + 4 = 12$, one knows $12 - 8 = 4$); and creating equivalent but easier or known sums (e.g., adding $6 + 7$ by creating the known equivalent $6 + 6 + 1 = 12 + 1 = 13$).
1 1.NBT.2	Understand that the two digits of a two-digit number represent amounts of tens and ones. Understand the following as special cases: 10 can be thought of as a bundle of ten ones called a "ten." The numbers from 11 to 19 are composed of a ten and one, two, three, four, five, six, seven, eight, or nine ones. The numbers 10, 20, 30, 40, 50, 60, 70, 80, 90 refer to one, two, three, four, five, six, seven, eight, or nine tens (and 0 ones).
1 1.NBT.4	Add within 100, including adding a two-digit number and a one-digit number, and adding a two-digit number and a multiple of 10, using concrete models or drawings and strategies based on place value , properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used. Understand that in adding two-digit numbers, one adds tens and tens, ones and ones; and sometimes it is necessary to compose a ten.
1 1.NBT.6	Subtract multiples of 10 in the range 10-90 from multiples of 10 in the range 10-90 (positive or zero differences), using concrete models or drawings and strategies based on place value , properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used.
2 2.NBT.5	Fluently add and subtract within 100 using strategies based on place value , properties of operations, and/or the relationship between addition and subtraction.
2 2.NBT.6	Add up to four two-digit numbers using strategies based on place value and properties of operations.
2 2.NBT.7	Add and subtract within 1000, using concrete models or drawings and strategies based on place value , properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method. Understand that in adding or subtracting three-digit numbers, one adds or subtracts hundreds and hundreds, tens and tens, ones and ones; and sometimes it is necessary to compose or decompose tens or hundreds.
3 3.NBT.2	Fluently add and subtract within 1000 using strategies and algorithms based on place value , properties of operations, and/or the relationship between addition and subtraction.

Addition and Subtraction

Grade 4	Fluently add and subtract multi-digit whole numbers using the standard algorithm.
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Grade Level	Multiply and Divide
3 3.OA.2	Interpret whole-number quotients of whole numbers, e.g., interpret $56 \div 8$ as the number of objects in each share when 56 objects are partitioned equally into 8 shares, or as a number of shares when 56 objects are partitioned into equal shares of 8 objects each. For example, describe a context in which a number of shares or a number of groups can be expressed as $56 \div 8$.
3 3.OA.7	Fluently multiply and divide within 100, using strategies such as the relationship between multiplication and division (e.g., knowing that $8 \times 5 = 40$, one knows $40 \div 5 = 8$) or properties of operations. By end of Grade 3, know from memory all products of one-digit numbers.
3 3.NBT.3	Multiply one-digit whole numbers by multiples of 10 in the range 10-90 (e.g., 9×80 , 5×60) using strategies based on place value and properties of operations.
4 4.NBT.5	Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.
4 4.NBT.6	Find whole-number quotients and remainders with up to four-digit dividends and one-digit divisors, using strategies based on place value , the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.
5 5.NBT.6	Find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors, using strategies based on place value , the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.
5 5.NBT.7	Add, subtract, multiply, and divide decimals to hundredths, using concrete models or drawings and strategies based on place value , properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used.

Multiplication and Division

Grade 5	Fluently multiply multi-digit whole numbers using the standard algorithm.
Grade 6	Fluently divide multi-digit numbers using the standard algorithm.

Addition, Subtraction, Multiplication, and Division with Decimals

Grade 6	Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.
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