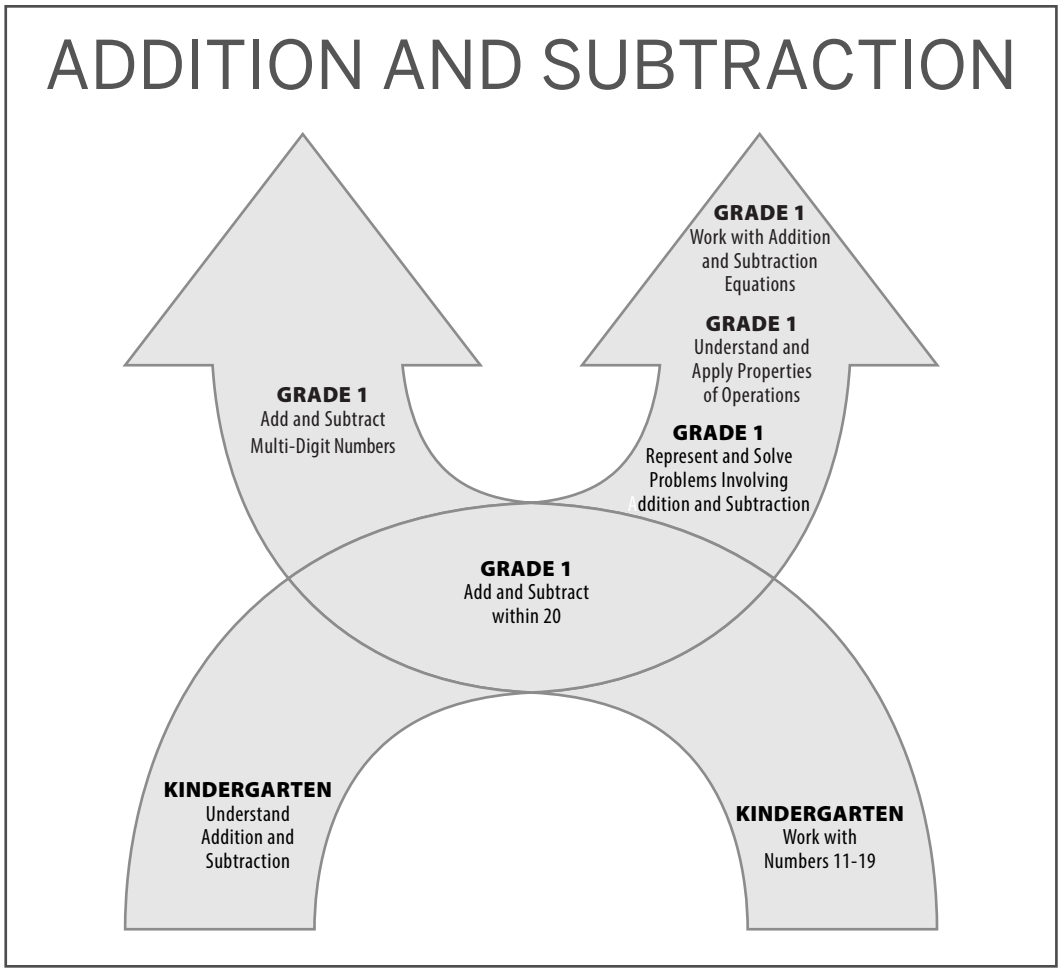
MATH K-1 Common Core Assessments

Kindergarten/Grade 1

INTRODUCTION



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Introduction to Addition and Subtraction

The assessments associated with the addition and subtraction progression are designed to help you assess student understanding of addition and subtraction problems and solution strategies.

This progression is fundamentally linked to the counting progression. Young children use strategies such as counting all or counting on to solve addition problems. Counting skills predict arithmetic skill in grades 1 and 2.

To understand students' strengths and weaknesses with addition and subtraction, one must consider the three aspects below:

1. The magnitude of the numbers in the problems
2. The type of problem
3. The strategy to solve the problem

MAGNITUDE OF NUMBERS

Problems get more difficult with greater numbers. This is because small numbers are easy to model directly using objects and drawings. Large numbers require more abstract representations and advanced solution strategies. Students start solving problems with sums to 5. They then expand to sums to 10, then to 20, and then beyond. In kindergarten, students mostly solve problems within 10. They expand to numbers to 20 in K.NBT.1.

TYPE OF PROBLEM

There are five basic types of addition and subtraction problems. The list below shows them in order of increasing difficulty.

- **Add to**: Al had 4 balls, then he got 1 more. How many does he have now?
- **Take from**: Al had 4 balls. He gave 2 away. How many are left?
- **Put together:** Al has 6 red pencils and 4 yellow pencils. What is the total number of pencils Al has?
- **Take apart**: Al has 10 balls some are blue 6 are red. How many are blue?
- **Compare**: Al has 7 pencils and Barb has 2 pencils. How many more pencils than Barbara does Al have?

Each type of problem can be set up in three different ways by changing the piece of information that is missing. The different setups are listed below, in order of increasing difficulty:

- **Result missing:** Al had 4 pencils, then he got 1 more. How many does he have now?

- **Part missing:** Al had 4 pencils then he got more. He has a total of 5 pencils. How many more did he get?
- **Start missing:** Al had some pencils and he got one more. Now he has a total of 5 pencils. How many did Al start with?

There is a useful table published on page 7 of the *Progressions for the Common Core State Standards in Mathematics (draft) K, Counting and Cardinality; K–5, Operations and Algebraic Thinking*. The table summarizes the types of problems students solve. Comparison problems are harder in part due to the associated vocabulary. Terms like *more*, *fewer*, *greater*, and *less* are difficult to understand. Students often think *more* and *fewer* are synonyms, and they require specific instruction to understand this vocabulary. Problem situations such as "Jim has 3 more spoons than Sarah" are challenging because the words may be confusing and "3" refers to an abstract quantity that is not easily modeled (it is not the amount Jim has nor the amount Sarah has, but rather refers to the relationship between those two groups). For these reasons, the CCSS do not include comparison problems until grade one.

STRATEGIES

Students should be encouraged to invent, discuss, explain, and use strategies that make sense to them. Strategies can be used with small numbers a year or more before they are used with larger numbers. There are three levels of strategies which students generally develop to solve addition and subtraction problems. Kindergarten students usually use level 1 strategies; level 2 and 3 strategies start in grade 1. Some students advance more quickly and should be encouraged to continue developing new strategies.

- **Level 1:** Direct modeling using objects or drawings and counting all the objects.
- **Level 2:** Counting on and tracking counts (related to the counting progression), counting on from the larger number, treating subtraction as an unknown addend problem (using the commutative property to rearrange), using drawings to count on and take away, representing with simple expressions and equations (3 + __ = 9).
- **Level 3:** Making a ten, decomposing and composing numbers, derived combinations, using associative property to rearrange addends to make problems easier, using doubles or doubles + 1 or 2, representing problems and solution strategies with equations (6 + 7 = 6 + 6 + 1 = 12 + 1).

The learning progression below shows how the abilities to work with numbers of increasing magnitude, solve different problem types, and use increasingly sophisticated solution strategies develop together.

All of the assessments in the addition and subtraction progression are tied to the learning progression below.

The assessments include:

- a blueprint (showing the specific common core standards targeted);
- directions for administration;
- a scoring sheet/interpretation guide;
- a copy of the learning progression;
- a guide to creating instructional groups.

The scoring sheet/interpretation guide makes it easy to record student responses and interpret students' approximate developmental levels with respect to the learning progression. You can use the instructional grouping guide to create groups of students at approximately the same level who need experience working on the same or similar activities.

Learning Progression: Add and Subtract

Developmental Level	Description
Solves “add to” and “take from” problems up to 5	Solves “add to” and “take from” problems with the result missing using sums up to 5 using level 1 strategies.
Solves “put together” and “take apart” problems to 5	Solves “put together” and “take apart” problems with the result missing using sums up to 5 and level 1 strategies.
Composes and decomposes numbers to 5	Decomposes and composes numbers to 5 (e.g., 5 can be decomposed into 4 +1 or 2 + 3). This is part of the basis for developing more advanced strategies (early K.OA.3).
Solves “add to” and “put together” problems to 10	Solves “add to” and “put together” problems with the result missing using sums up to 10. Solves by using level 1 strategies, and may start using drawings to model problems (K.OA.1, K.OA.2).
Solves “take away” and “take apart” problems to 10	Solves “take away” and “take apart” problems with the result missing by using level 1 strategies and drawings to model problems (K.OA.1, K.OA.2).
Composes and decomposes numbers to 10	Decomposes and composes numbers to 10 (e.g., 9 is 1 + 8, 2 + 7, 3 + 6, 4 + 5). For any number from 1 to 9, finds the number that makes 10 (K.OA.3, K.OA.4).
Fluently adds and subtracts to 5	Develops fluency and automaticity with addition and subtraction facts to 5. Fluency develops from experience with models, counting strategies, and contextual situations that make sense to students (K.OA.5).
Composes and decomposes numbers to 20	Understands teen numbers as ten ones and some more ones (K.NBT.1).
Solves simple comparison problems to 10	Solves problems involving adding on to one number to get to another, greater number (e.g., “There are 5 circles and 8 squares. How many circles do you need to have the same number of circles and squares?” using level 1 strategies and drawings).
Solves “part missing” problems to 10	Solves addition problems with a part missing using level 2 strategies. Solves subtraction problems such as 8 - __ = 6 by separating groups of objects. Changes subtraction problems into missing addend problems (level 2 strategy) (1.OA.1, 1.OA.4).
Solves “result missing” problems to 20	Solves ”add to,” “take away,” “put together,” and “take apart” problems with result missing by using level 2 strategies and numbers up to 20 (1.OA.1, 1.OA.5, 1.OA.8).

Solves “part missing” problems to 20	Solves “add to,” “take away,” “put together,” and “take apart” problems with parts missing using flexible strategies (early level 3), including representing with an equation and applying properties of operations. Begins to solve “start missing” problems but only by trial and error (1.OA.1, 1.OA.3, 1.OA.7, 1.OA.8).
Solves “start missing” problems with level 2 strategies to 20	Uses commutativity to make “start missing” problems into “part missing” problems (1.OA.1, 1.OA.3, 1.OA.8).
Solves all problem types to 20 with level 3 strategies	Uses flexible strategies including derived combinations (5 + 5 = 10 so 5 + 6 = 11) to solve all types of addition and subtraction problems (1.OA.1, 1.OA.3, 1.OA.6, 1.OA.8).
Solves problems with three addends to 20	Extends abilities to solve addition problems to problem situations involving three whole numbers with unknowns in any position (1.OA.2).
Has fluency to 10, and ability to 20	Develops fluency and automaticity with addition and subtraction facts to 10. Fluency develops from experience with models, counting strategies, and contextual situations that make sense to students (1.OA.6).
Composes with tens and ones, to 100	Understands two-digit numbers as some number of tens and some number of ones. Uses flexible strategies to solve problems involving multi-digit addition (1.NBT.5, 1.NBT.6).
Solves multi-digit problems	Uses composition of tens and all previous strategies to solve multi-digit addition and subtraction problems (1.NBT.4).

References

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