

The Common Core Companion at a Glance

Suggested Materials: Provides teachers with a list of materials that will be helpful in introducing the concepts in this domain. “Reproducible” indicates that there is a Reproducible that you can use to make multiple copies in the Resources section in the back of the book.

SUGGESTED MATERIALS FOR THIS DOMAIN

K	1	2	
✓	✓	✓	Objects for counting such as beans, linking cubes, two-color counter chips, coins
✓			Five frames (Reproducible 1)
✓	✓	✓	Ten frames (Reproducible 2)
	✓	✓	Double ten frames (Reproducible 3)
✓	✓	✓	Hundreds chart (Reproducible 4)
✓	✓	✓	Dot cards (Reproducible 5)
✓	✓		Numeral cards (Reproducible 6)
	✓	✓	Number line to 20 (Reproducible 7)
	✓	✓	Open number line (Reproducible 8)
✓	✓	✓	Part-Part-Whole chart (Reproducible 9)
✓	✓	✓	Place value chart (Reproducible 10)
✓	✓	✓	Various Dice (1–6, 1–10)
✓	✓	✓	Various Spinners (1–4, 1–5, 1–6, 1–10)

Operations and Algebraic Thinking

Domain Overview

KINDERGARTEN

Students build upon their understanding of counting to develop meaning for addition and subtraction through modeling and representing problem situations, using concrete objects and pictorial representations. This domain comprises the major work of kindergarten and will be developed across the entire school year. Table 1 in the Resource section provides a detailed chart of addition and subtraction situations.

GRADE 1

As first graders continue to develop fluency with addition and subtraction, problem solving provides an opportunity for them to make sense of these operations using various situations and contexts. First graders extend their work from kindergarten by representing additional situations for addition and subtraction (Table 1). They also develop more sophisticated strategies for addition by counting on rather than starting with 1, for subtraction by counting back from a total (sum), and by composing and decomposing addends.

Note that in the early grades the term *total* is used rather than *sum* when referring to the answer in addition or the starting number in subtraction. This is intentional in order to avoid any confusion between *sum* and *some*, words that sound the same but have very different meanings.

GRADE 2

As students demonstrate understanding, skill, and ability to apply addition and subtraction to all problem situations, the range of numbers with which they work increases to 100. Problem situations include simple two-step problems for students to model and explore. Students extend their expertise with mental mathematics strategies (Table 2) initially using concrete materials and later as they continue to practice and become fluent with addition and subtraction facts including all facts through sums of 20.

This domain is not taught in isolation from the Number and Base Ten domain. Students work across domains to develop a deep understanding of addition and subtraction focusing on the instructional shifts of developing conceptual understanding, building skill and fluency, and applying addition and subtraction in problem contexts.

Domain Overview: Gives a brief description of the big ideas, allowing you to see how the mathematical ideas develop across grade levels.

Key Vocabulary: Vocabulary included in the domain, noting the grade levels at which that term is used. This terminology can be used for building a word wall in the classroom. Students should be able to use these terms in talking about mathematics in discussions unless otherwise noted. Standard for Mathematical Practice 6 (Attend to Precision) calls for students to use mathematical terminology appropriately.

KEY VOCABULARY			
K	1	2	
✓	✓	✓	add —to combine or join together <i>related words: add, and, plus, join, put together, (+)</i>
	✓	✓	* associative property of addition —an extension of the commutative property, to change the order and group 2 addends to find convenient sums (such as 10) in order to make the addition easier. Note that students do not use parenthesis at this level. The focus is on looking for sums of 10. $4 + 8 + 2 = 4 + 10 = 14$ or $6 + 8 + 4 = 6 + 4 + 8 = 18$
	✓	✓	* commutative property of addition —reversing the order of the addends does not change the total (sum) $8 + 5 = 13$ and $5 + 8 = 13$; therefore, $8 + 5 = 5 + 8$
✓	✓	✓	compare —to look for similarities or differences among numbers
	✓	✓	compose —put a number together using other numbers $1 + 9$, $2 + 8$, $3 + 7$, $4 + 6$, $5 + 5$, $1 + 2 + 3 + 4$ are ways to compose 10
	✓	✓	decompose —separate a number into parts using other numbers 8 can be decomposed into $4 + 4$, $3 + 5$, $2 + 2 + 2 + 2$
✓	✓	✓	difference —the amount by which one number is greater or less than another number. The difference can be found by subtracting, comparing, or finding a missing addend.
✓	✓	✓	equal (=) —same as in value or size
	✓	✓	equation —a mathematical sentence in which one part is the same as, or equal to, the other part

Domain:
General mathematical topic for this group of standards.

Cluster: Statements that summarize related standards.

Operations and Algebraic Thinking

K.OA.A*

Cluster A

KINDERGARTEN

Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from.

STANDARD 1 **K.OA.A.1:** Represent addition and subtraction with objects, fingers, mental images, drawings¹, sounds (e.g., claps), acting out situations, verbal explanations, expressions, or equations.
¹Drawing need not show detail but should show the mathematics in the problem.

STANDARD 2 **K.OA.A.2:** Solve addition and subtraction word problems, and add and subtract within 10, e.g., by using objects or drawings to represent the problem.

STANDARD 3 **K.OA.A.3:** Decompose numbers less than or equal to 10 into pairs in more than one way, e.g., by using objects or drawings, and record each decomposition by a drawing or equation (e.g., $5 = 2 + 3$ and $5 = 4 + 1$).

STANDARD 4 **K.OA.A.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.

STANDARD 5 **K.OA.A.5:** Fluently add and subtract within 5.

*the cluster

Standards:
Mathematical statements that define what students should understand and be able to do.

Each cluster begins with a brief description of the mathematics in that cluster.

K = Grade
 OA = Domain
 A = Cluster

Operations and Algebraic Thinking K.OA.A

Cluster A: Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from.
Kindergarten Overview

Students begin to explore addition and subtraction through solving problems first using concrete objects and then using pictures, eventually becoming familiar with expression ($3 + 5$) and equation ($3 + 5 = 8$) notation. The vocabulary of addition and subtraction actions emphasize addition as joining two sets or adding on to a set. Taking items from a set or taking apart a set are subtraction situations that students experience by modeling (Table 1). These conceptual understandings are the basis for relating addition and subtraction; they also provide early strategies that lead to fact fluency. Note that the word *total* is used in place of *sum* at this level to avoid confusion with its homonym, *some*.

Standards for Mathematical Practice
 SFMP 1. Make sense of problems and persevere in solving them.
 SFMP 2. Use quantitative reasoning.
 SFMP 3. Construct viable arguments and critique the reasoning of others.
 SFMP 4. Model with mathematics.

In kindergarten, students begin to explore the operations of addition and subtraction by using a variety of concrete materials to model specific problem situations. As students develop understanding of numbers and their meaning, they should develop the habit of asking themselves if their answer makes sense. Within the classroom lesson, students should have many opportunities to explain and justify their thinking to the teacher, to a partner, to a small group, or to the class. They also learn to listen to the explanations of classmates.

Related Content Standards
 1.OA.B.1 1.OA.B.4 1.OA.B.8 1.NB.TC.4 1.NB.TC 2.OA.A.1 2.OA.A.2

Related Content Standards: Provides a list of standards connected to this topic in other grade levels, as well as standards in this grade level related to this topic. Consider the related standards as you plan your instruction for each cluster.

Although it is likely you will use a variety of standards of mathematical practice in teaching each cluster, this section gives examples of how you might incorporate some of the practices into your instruction on this topic.

The standard as written in the Common Core is followed by an explanation of the meaning of the mathematics in that standard and what it looks like in the classroom.

An overview of actions the teacher might take in introducing and teaching the standard. This is not meant to be all inclusive, but rather to give you an idea of what classroom instruction might look like. We include illustrations of how to use materials to teach a concept where using models and representations is called for in the standard.

STANDARD 1 (K.OA.A.1)


Represent addition and subtraction with objects, fingers, mental images, drawings, sounds (e.g., claps), acting out situations, verbal explanations, expressions, or equations.


Drawings need not show details, but should show the mathematics in the problem. (This applies wherever drawings are mentioned in the Standards.)


Students develop an understanding of the meaning of addition and subtraction by modeling how they can put together (compose) or take apart (decompose) up to 10 objects in different ways. It is critical for students to have a variety of experiences with concrete materials, progress to drawing pictures to express their thinking, and finally see written addition and subtraction expressions and equations. The teacher may write equations if students are not ready to do this on their own.

What the TEACHER does:

- Give students tasks in which they compose and decompose numbers up to 5 using concrete materials and counting.

chips


linking cubes


five frame


What the STUDENTS do:

- Use concrete materials to model how numbers up to 8 are composed (put together).
- Describe their models using pictures, words, and numbers with emphasis on appropriate addition and subtraction terminology.
- Extend their work to numbers from 6 to 10.
- Match their models with equations and expressions provided by the teacher.

Addressing Student Misconceptions and Common Errors

If students do not have time to draw pictures before working with numerical expressions and equations, they may be more likely to use finger counting and rote memorization in working with addition and subtraction—especially when learning basic facts.

Notes

Some examples of what students might be doing as they explore and begin to understand the standard. Again, this is not intended to be directive but rather to frame what student actions might look like.

Each standard concludes with a description of student misconceptions and common errors and suggested actions to address those misconceptions.

We have provided a complete sample planning page for one individual standard at the end of each grade level. It is not meant to be a final lesson plan, but rather to identify the areas you should consider while planning your lessons for the standards.

Defines the purpose of the lesson and shows how it connects to previous (and future) ideas.

Identifies the mathematical practices that might be emphasized in this lesson.

A planning template is provided at the end of each cluster. This template is provided for your use as you consider instructional actions around a particular standard. You might want to make copies of this page and use them for each standard within the cluster. This is not intended to be an all-inclusive lesson plan. Rather, it gives you a place to record your thoughts about teaching a mathematical topic as you read the standard.

Sample PLANNING PAGE K.O.A.A

Operations and Algebraic Thinking
Cluster A: Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from.

Standard: K.OA.A.3. Decompose numbers less than or equal to 10 into pairs in more than one way, e.g., by using objects or drawings, and record each decomposition by a drawing or equation (e.g., $5 = 2 + 3$ and $5 = 4 + 1$).

Standards for Mathematical Practice:
SFMP 2. Use quantitative reasoning.
SFMP 4. Model with mathematics.

Students explore combinations for numbers ≤ 10 using concrete materials and drawings. Within the classroom lesson students should have many opportunities to explain and justify their thinking to the teacher, to a partner, to a small group, or to the class. They also learn to listen to the explanations of classmates.

Goal:
Students use various materials to compose and decompose numbers from 2 to 6 using concrete materials and drawing their representations. As students explain their thinking and describe their work, they may also begin to notice patterns such as 5 can be shown as 3 blue tiles and 2 red tiles and also be shown as 2 blue tiles and 3 red tiles.

Planning:
What's Your Goal?

Materials: Two colors of tiles, two colors of linking cubes, two-color counters, one-inch graph paper, nickels, dimes, numeral cards 2-6, a die numbered 1 to 6, a spinner numbered 2 to 6.

Sample Activity:
Set up stations in the classroom. Put a set of like materials at each station with a deck of numeral cards (2-6) or one die (1-6) or a spinner numbered 2-6.
Students roll the die, spin the spinner, or take one numeral card. That is the goal number. They use the materials to represent that number in as many ways as possible. After ample experiences with concrete materials, students who are ready may draw their combinations using graph paper.
Students describe their combinations and any patterns they found.

Questions/Prompts:
What number did you use?
How many tiles will you need altogether?
How can you show 6 using red and blue tiles?
Is there another way to show 6 using the red and blue tiles?
Show all the ways you can find to make 6 using the tiles.
Describe the combinations you found.
Do you have all of the combinations? How can you be certain?

Differentiating Instruction
Struggling Students: Limit the range of numbers for students who cannot work with numbers through 6. You may need to direct these students to place tiles on the graph paper starting with one red tile, for example, and filling in the rest with blue tiles until the students reach the goal number. Follow by starting with 2 red tiles and filling in the rest with blue tiles until the students reach the goal number. Students who have difficulty transferring their physical representations to graph paper may need more experience with only the physical models. They can also place the models directly on the graph paper and color in each square as they move each piece to the side.
Extension: For students who show all of the combinations, extend the range of numbers in the activity. Ask them to organize their combinations and describe any patterns they see. These students may also record the equations for each combination they make.

KINDERGARTEN

PLANNING PAGE K.O.A.A

Cluster A: Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from.

Standard:

Standards for Mathematical Practice:

Goal:

Planning:

Materials:

Sample Activity:

Questions/Prompts:

Differentiating Instruction:
Struggling Students:

Extension:

Lists the materials that will be used to teach this standard.

Includes directions for the task students will complete.

It is important to anticipate student thinking throughout the lesson. Think about the questions or prompts you might give to help build student understanding and encourage student thinking.


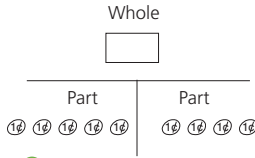
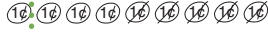
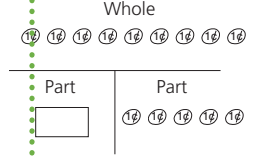
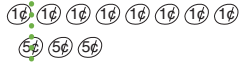
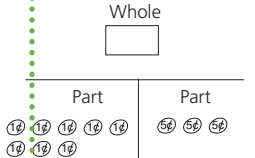
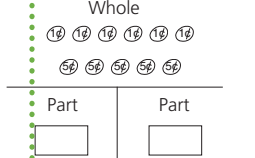
Provides an area where teachers can identify how they might adjust the lesson to (1) address the needs of students who are struggling and (2) extend the lesson for students who demonstrate understanding of the mathematics.

In the resources section you will find an overview of the standards for mathematical practice and what each standard means for students, the effective teaching practices from NCTM's Principles to Actions, and an overview of each practice for teachers to consider and implement; Table 1 which provides problem solving situations, Table 2 which provides strategic competencies for students, and Table 3 which scaffolds and includes modeling examples for the operations of addition and subtraction across grades K-2; and Reproducibles for some of the materials recommended for each grade level.

Various problem situations for addition and subtraction with suggested grade levels.

An example of a problem that exemplifies the situation.

Equation(s) that represent the situation.

SITUATION	PROBLEM	PHYSICAL MODEL	PART PART WHOLE	EQUATION(S)												
Add to— result unknown Grades K, 1, 2	Frank had 5 pennies. Mark gave him 4 more. How many pennies does Frank have?			$5 + 4 = \square$												
Take from— result unknown Grades K, 1, 2	Frank had 9 pennies. He spent 5 pennies on a jawbreaker. How many pennies does he have left?			$9 - 5 = \square$												
Put together take apart—total unknown Grades K, 1, 2	Anna has 8 pennies and 3 nickels. How many coins does she have?			$8 + 3 = \square$												
Put together take apart— addends unknown Grades K, 1, 2	Anna has 11 coins. Some are pennies and some are nickels. How many pennies and how many nickels could Anna have?	<p>Show table with different combinations of pennies and nickels that will total 11 (use illustrations of coins)</p> <table border="0"> <thead> <tr> <th>Pennies</th> <th>Nickels</th> </tr> </thead> <tbody> <tr> <td>1. </td> <td>10. </td> </tr> <tr> <td>2. </td> <td>9. </td> </tr> <tr> <td>3. </td> <td>8. </td> </tr> <tr> <td>4. </td> <td>7. </td> </tr> <tr> <td>5. </td> <td>6. </td> </tr> </tbody> </table>	Pennies	Nickels	1.	10.	2.	9.	3.	8.	4.	7.	5.	6.		$1 + 10 = 11$ $2 + 9 = 11$ $3 + 8 = 11$ $4 + 7 = 11$ $5 + 6 = 11$ $6 + 5 = 11$ $7 + 4 = 11$ $8 + 3 = 11$ $9 + 2 = 11$ $10 + 1 = 11$
Pennies	Nickels															
1.	10.															
2.	9.															
3.	8.															
4.	7.															
5.	6.															

A physical model that students might use to represent the situation.

An alternate model (part whole/bar model).

This table includes a scaffolded list of concepts and skills that students should develop in K–2.

Grade Level	Description	Example	Model	Other strategies/models
K 1 2	1 digit + 1 digit (basic facts with sums to 20)	9 + 7		Make a ten Decompose $7 = 1 + 6$ Add $9 + 1 + 6 = 16$
1	2 digit + 1 digit (no regrouping)	23 + 6		Benchmark numbers Open number line Basic facts
1	Add multiples of 10	30 + 50		Place value Basic facts Open number line

An example of place value based models

Other strategies that support student understanding

A variety of reproducibles for student use.

Hundreds Chart

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100