Teacher Guide to Clarification

2.NBT.7

Place Value Strategies: composing and decomposing using concrete models and drawings

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; sometimes it is necessary to compose or decompose tens or hundreds.

Concrete Models and Drawings

Students will need to solve, show and explain reasoning of addition and subtraction within 1000. **2nd graders will not use the standard** algorithm just yet as they are building their conceptual knowledge. Possible strategies students can use to model and justify their thinking are open number lines, place value mats/charts, and base ten blocks. Students may also use technology to present their reasoning and explanations; for example, interactive white boards, document cameras, iPads and apps (Educreations, showme).

As students use the strategies shown below they are decomposing and composing into hundreds and tens. Encourage students to make hundreds and tens.

Open Number Line – An open number line is a term used to describe the idea of a number line without showing all of the tick/hash marks. This strategy uses a visual to help students compose and decompose into hundreds and tens and place value. Eventually, students will be able to apply this thinking in order to reason through a problem and solve it mentally.

Addition Example 254 + 177 =

Student 1: I started at 254 and jumped up 100 to 354. Then I jumped 50 and then 20. This brought me to 424. Then I jumped up 6 to 430 plus on more jump, 431.

Watch the Open Number Line demonstration here, using educreations iPad app.

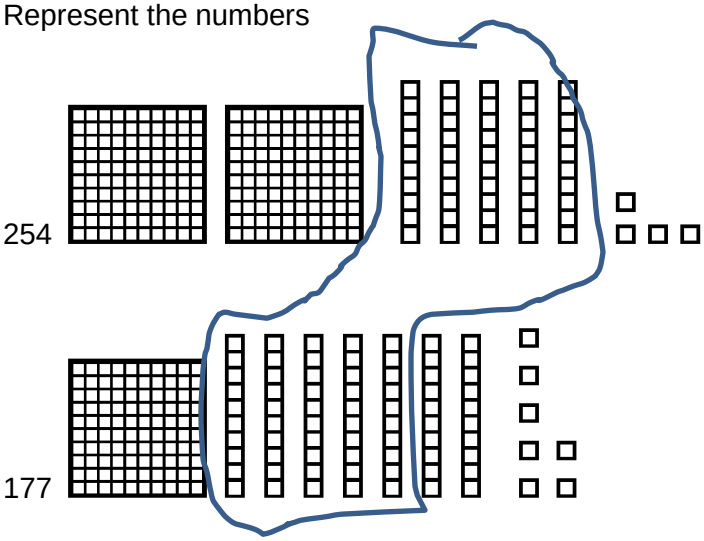
http://www.educreations.com/lesson/view/open-number-line/20998731/?s=BSBzvz&ref=app

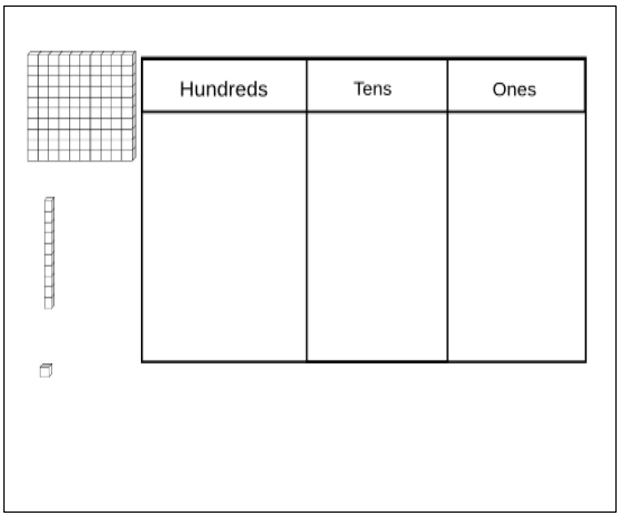
It is interesting to see all the ways students "Hop" or "Jump" up the number line. (composing and decomposing)

Addition Example 254 + 177 =

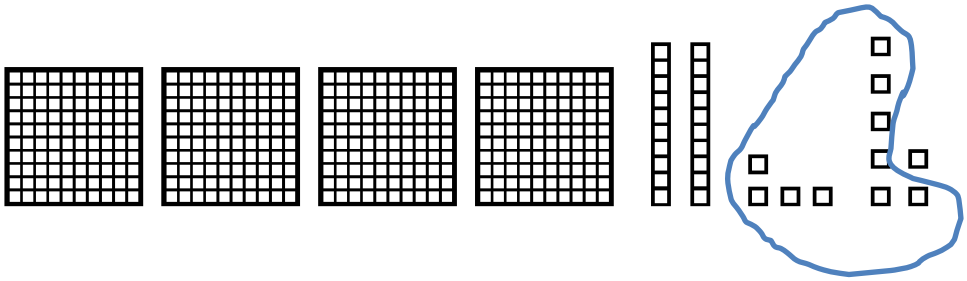
Using Base Ten Blocks and a Place Value Chart

Represent the numbers



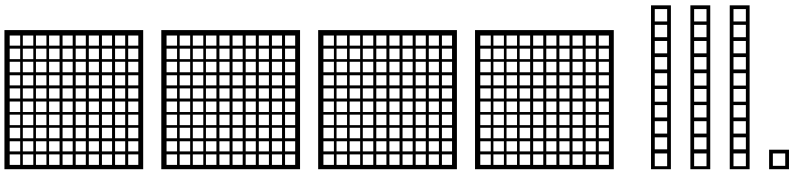


Trade in any tens for hundreds

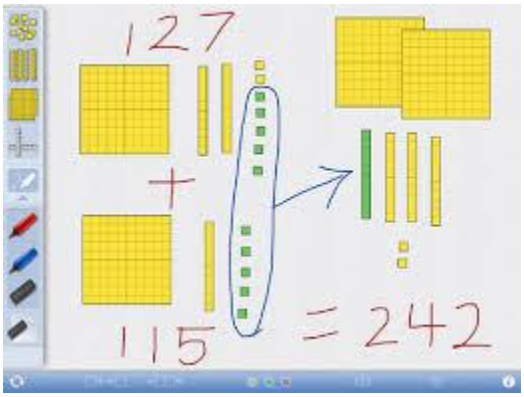


Now trade in any ones for tens

Now add your total



You can use the **Number Pieces** app on the iPad and allow students to represent their findings.

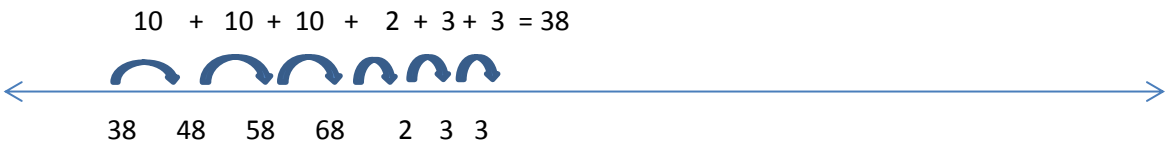


FREE App

Subtraction Examples 76 – 38 =

Open Number Line

- Start at 38 and see how many hops we need to get to our target number 76. You can think of subtraction as addition with the Open Number Line. This shows the relationship between addition and subtraction.

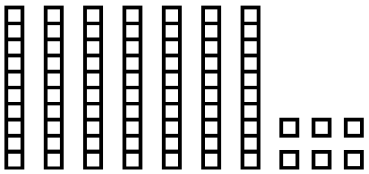


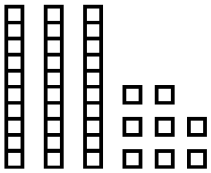
Eventually, we can take away the visual model and students can do this in their head to solve mentally. Showcase all the ways students decided to "jump" up to their target number.

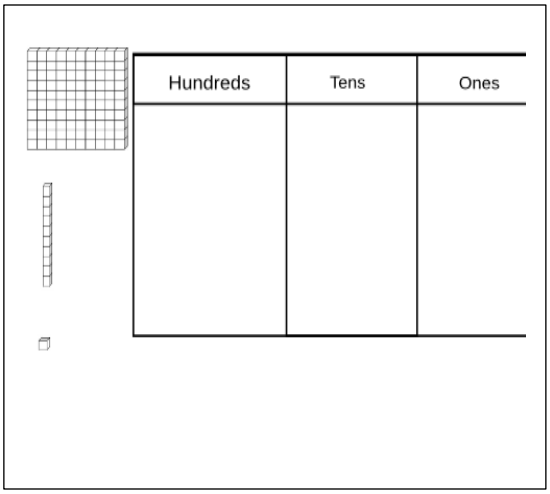
Subtraction Examples 76 – 38 =

Using Base Ten Blocks and Place Value Chart/ mat

Represent the problem

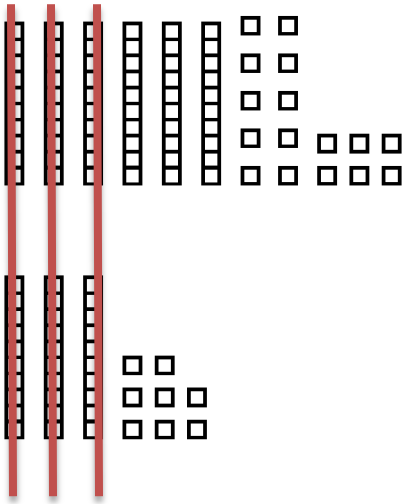


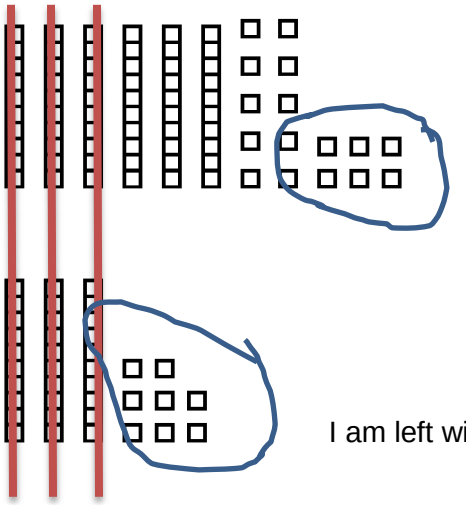




I can't take 8 ones away from 6 ones so I had to break up a ten into ones

Now take away





I am left with 38

Coherence and Connections: Need to Know

Below Grade Level	At Grade Level	Above Grade Level
1.NBT.2	**2.NBT.7** 2.NBT.1 2.NBT.6 2.NBT.9	3.NBT.2

In this standard students extend their knowledge from 2.NBT.5 by increasing the size of numbers (two three-digit numbers). Students are continuing to build place value knowledge by using concrete models, drawings and hands-on manipulatives. It is important to build the conceptual knowledge of composing and decomposing tens and hundreds. This standard is culminating for the conceptual knowledge built in this domain **Numbers and Operations in Base Ten (NBT)**

Students will need to practice addition and subtraction with these models and showcase their own mathematical strategies. Other students will then critique their reasoning (MP 3).

Examples of Major Within-Grade Dependencies

Understanding place value (cluster 2.NBT.A) is the foundation for using place value understanding and the properties of operations to add and subtract (cluster **2.NBT.B**). (Mastery of the two clusters can grow over time in tandem with one another.) Adding and subtracting with 1,000 (2.NBT.7) involves adding and subtracting hundreds with hundreds, tens with tens, and ones with ones, sometimes composing or decomposing tens or hundreds. These ideas and methods rest on an understanding of the place value units (2.NBT.1, building on 1.NBT.2).

Knowing single-digit sums from memory (2.OA.2) is the basis for adding and subtracting multi-digit numbers fluently and efficiently in general (cluster **2.NBT.B**).

Example of Opportunity for Connections among Standards, Clusters or Domains

Students' work with addition and subtraction word problems (2.OA.1) can be coordinated with their growing skill in multi-digit addition and subtraction (2.OA.2, cluster **2.NBT.B**).

Example of Opportunity for In-Depth Focus

It takes substantial time throughout the year for students to extend addition and subtraction to 1,000, connecting steps in the computation to what they know about place value and properties of operations.

PARCC Draft Model Content Frameworks: Mathematics Grades K-2 (2013, December). Retrieved May 10, 2014, from http://parcconline.org/sites/parcc/files/PARCCMCFMathematicsNovember2012V3_FINAL_0.pdf

Representations such as manipulative materials and drawings may be used to support reasoning and explanations about addition and subtraction with three-digit numbers.2.NBT.7

When students add ones to ones, tens to tens, and hundreds to hundreds they are implicitly using a general method based on place value and the associative and commutative properties of addition.

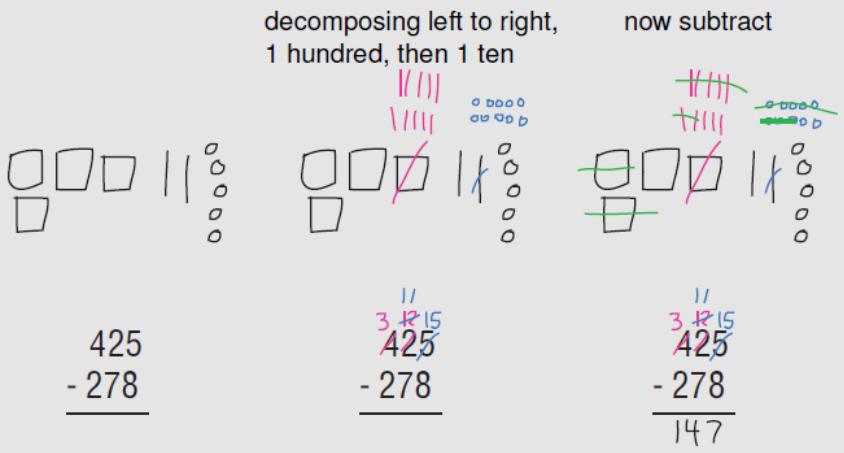
Examples of how general methods can be represented in numerical work and composition and decomposition can be represented in math drawings are shown below.

Addition: Recording combined hundreds, tens, and ones on separate lines

456	456	456	456
+167	+167	+167	+167
	500	500	500
		110	110
			13
			623

Addition proceeds from left to right, but could also have gone from right to left. There are two advantages of working left to right: Many students prefer it because they read from left to right, and working first with the largest units yields a closer approximation earlier.

Subtraction: Decomposing where needed first



All necessary decomposing is done first, then the subtractions are carried out. This highlights the two major steps involved and can help to inhibit the common error of subtracting a smaller digit on the top from a larger digit. Decomposing and subtracting can start from the left (as shown) or the right.

Drawings and diagrams can illustrate the reasoning repeated in general methods for computation that are based on place value. These provide an opportunity for students to observe this regularity and build toward understanding the standard addition and subtraction algorithms required in Grade 4 as expressions of repeated reasoning (MP.8).

As you read below notice how the standards are asking students to use their knowledge of:

- **Place value**
- **Composing and decomposing to make tens and hundreds.**
- **Associative and Commutative Property**
- **Relationships between addition and subtraction**
- **Fluency**

At Grade 2, composing and decomposing involves an extra layer of complexity beyond that of Grade 1. This complexity manifests itself in two ways. First, students must understand that a hundred is a unit composed of 100 ones, but also that it is composed of 10 tens. Second, there is the possibility that both a ten and a hundred are composed or decomposed. For example, in computing 398 + 7 a new ten and a new hundred are composed. In computing 302 - 184, a ten and a hundred are decomposed.

Students may continue to develop and use special strategies for particular numerical cases or particular problem situations such as Unknown Addend. For example, instead of using a general method to add 398 + 7, students could reason mentally by decomposing the 7 ones as 2 & 5, adding 2 ones to 398 to make 400, and then adding the remaining 5 ones to make 405. This method uses the associative

property of addition and extends the make-a-ten strategy described in the OA Progression. Or students could reason that 398 is close to 400, so the sum is close to 400 + 7, which is 407, but this must be 2 too much because 400 is 2 more than 398, so the actual sum is 2 less than 407, which is 405. Both of these strategies make use of place value understanding and are practical in limited cases.

Subtractions such as 302 - 184 can be computed using a general method by decomposing a hundred into 10 tens, then decomposing one of those tens into 10 ones. Students could also view it as an unknown addend problem 184 + 302, thus drawing on the relationship between subtraction and addition. With this view, students can solve the problem by adding on to 184: first add 6 to make 190, and then add 10 to make 200, next add 100 to make 300, and finally add 2 to make 302. They can then combine what they added on to find the answer to the subtraction problem: 6 + 10 + 100 + 2 = 118. This strategy is especially useful in unknown addend situations. It can be carried out more easily in writing because one does not have to keep track of everything mentally. This is a Level 3 strategy, and is easier than the Level 3 strategy illustrated below that requires keeping track of how much of the second addend has been added on. (See the OA Progression for further discussion of levels.)

When computing sums of three-digit numbers, students might use strategies based on a flexible combination of Level 3 composition and decomposition and Level 2 counting-on strategies when finding the value of an expression such as 148 + 473. For example, they might say, ”100 and 400 is 500. And 70 and 30 is another hundred, so 600. Then 8, 9, 10, 11 . . . and the other 10 is 21. So,621.” Keeping track of what is being added is easier using a written form of such reasoning and makes it easier to discuss. There are two kinds of decompositions in this strategy. Both addends are decomposed into hundreds, tens, and ones, and the first addend is decomposed successively into the part already added and the part still to add.

Common Core Standards Writing Team. (2013, September 19). *Progressions for the Common Core State Standards in Mathematics(draft). K-5 Number and Operations in Base 10.* Tucson, AZ: Institute for Mathematics and Educations, University of Arizona.

This section of the progression document brings to light how the new standards are asking teachers and students to go deeper and to build that foundational number sense!

Truly a shift in instruction, compared to how we used to teach addition and subtraction.

This also explains why, in grade 2, teachers will need to spend the whole year on these strategies and not lay down the traditional algorithm of regrouping.

Classroom Resources

PPT

Hot Questions

1 Add 478 + 234. Show two different ways.

2 If I add 587 + 389 will the total be more than 1000 or less than 1000. How do you know?

(a) If I have 587 what number could I add to be more than 1000?

(b) What is the smallest number I could add to make more than 1000?

3 Subtract 781 – 234. Show two different ways.

4 Can I subtract 567 – 489 without trading any tens and ones? How do you know? Solve the subtraction problem

Additional Resources

Free resource from K-5 math teaching resource. Allow students to use multiple strategies to add and subtract.

http://www.k-5mathteachingresources.com/support-files/friendly-numbers-subtraction.pdf

Place Value Strategies with 3 Digit addition and subtraction

http://www.k-5mathteachingresources.com/support-files/3-digit-subtraction-split.pdf

http://www.k-5mathteachingresources.com/support-files/3-digit-addition-split.pdf

Performance Assessment Task from Inside Mathematics

http://www.insidemathematics.org/assets/common-core-math tasks/peanuts%20and%20ducks.pdf