Teaching Manual: *Basic Number Sense*

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BASIC NUMBER SENSE

NOTE: The exercises in this unit teach the mechanics of addition and subtraction (with and without carrying and borrowing). For exercises (with pictures and concrete materials) that will help your student understand why the standard algorithms for addition and subtraction work, see the Number Sense 1 and Number Sense 2 units in the Teacher's Edition of the JUMP Teaching Manual.

BN-1 - BN-4 – Counting, Naming, and Ordering Numbers
The exercises for Sections BN-1 to BN-4 introduce extremely basic skills. If your student already knows how to count, name and order numbers, you can skip these sections. We have only provided a few worksheets for counting, naming, and ordering numbers as models for how you might teach each skill. You will likely need to design extra worksheets of each type for weaker students.

Your student should understand that there is a one-to-one correspondence between, say, the 9 objects they count and the number ‘9’ or the word ‘nine’. Students should memorize the special cases of 11-19, where there are special words for each of these numbers. From twenty on, they only need to append the single digit to the tens number, e.g. twenty-six.

Students may be interested to know that while we mostly use the decimal system (because of the numbers on our fingers and toes) this is by no means the only number system possible. Other number systems exist and they have a rich history, e.g. the 60 number system used by the ancient Babylonians (of which the minutes/seconds numbering is a relic) and the modern binary system used in today’s information systems.

BN-5A – Single Digit Addition
Note to classroom teachers: If your students can easily add single digit numbers, then they should find Worksheet BN-1 A quite simple. For weaker students, I recommend the following method for addition:

Addition (Where one number is a single digit)
Example: 16 + 3 =

Step 1: Say the larger number ("16") with your fist closed.

16

Step 2: Count up by ones, raising your thumb first, then one finger at a time until you have the same number of fingers up as the lower number.

17 18

Step 3: The number you say when you have the second number of fingers up is the answer (in this case you say 19 when you have three fingers up, so 19 is the sum of 16 & 3).
A great bonus question would be to add a multi-digit number to a single digit number (e.g. 1653 + 5). Just make sure your students can count up to the thousands and beyond.

Eventually you should wean your student off using their fingers to add. You can help them memorize basic addition facts using flashcards and drills. (But you should never make a weaker student feel bad about using their fingers.)

**BN-5B – Single Digit Addition with Multiples of Ten**

The exercises for this section teach students how to add single digit numbers to multiples of ten (i.e. numbers ending in zero) by first recognizing how many groups of ten are in the multiple of ten (10, 20, 30 etc.) and then appending the single digit to the leading digit of the multiple of ten (e.g. twenty plus three is twenty-three in the example below).

![Example](image)

In the bonus exercises, the students are asked to add single digits to multiples of a hundred.

**BN-5C – Triple Single Digit Addition**

The exercises for this section teach your student how to add three numbers, by first adding the first two numbers (by counting the shaded blocks) then adding that sum and the third number. If your students need to use their fingers, they should say the sum (with closed fist) of the first two numbers, and then count up by on their fingers to get the right answer.

(I.e. for 5 + 2 + 1, 5 + 2 = 7, so your student would say 7 with a closed fist and count up 1 finger to get 8)

![Example](image)

Notice that the shaded boxes do not overlap, so that the students can satisfy themselves that the answer above is 8 by copying all the shaded blocks onto a single block of blank squares thus

The answers to these exercises all amount to 10 or less. The bonus questions focus on numbers greater than 10.

**BN-6A – Multiple Digit Addition (No Carrying)**

In this section, students line up two multi-digit numbers and adding them (each digit must be matched to the corresponding digit of the other number). In all these exercises, the numbers are of the same length and the addition does not require carrying.

The first page provides boxes to help your student align the digits of the numbers. On the second page, the students have to align the numbers and perform the sum without the boxes.
**BN-6B - Multiple Digit Addition with Zeroes (No Carrying)**

In this section, one of the numbers to be added ends in the zero. The sum of a single digit and zero is simply that same digit (e.g. $5 + 0 = 5$; $7 + 0 = 7$). This applies even when numbers are aligned for addition:

$$
\begin{array}{c}
52 \\
+40 \\
\text{---} \\
\hline
2
\end{array} 
\quad 
\begin{array}{c}
52 \\
+40 \\
\text{---} \\
\text{---} \\
\hline
92
\end{array} 
\quad 
\begin{array}{c}
52 \\
+40 \\
\text{---} \\
\hline
92
\end{array} 
$$

You may want to tell students that understanding the idea of zero puts them ahead of all the adults of the ancient world. Zero was not known and arrived in Europe from India via the Arabs. As an example, if a child (or more likely an adult) several hundred years ago was adding the first set of numbers (17+30), he or she would need to deal with the Roman numerals XVII + XXX, so the first number has 4 letters and the second one 3 letters. How could anybody add that?! Very few people could.

**BN-6C - Multiple Digit Addition with Gaps (No Carrying)**

In the exercises for this section the numbers to be added are of different lengths (e.g. one number might be a single digit and the other may be 2 or 3 digits long). Make sure your students know that they must align all numbers to the right. This is different from what students normally see in written text (which is usually aligned to the left of the page).

**BN-7A – Multiple Digit Addition with Carrying**

The exercises in this section introduce carrying. Have your students do each of the following steps separately:

1. **Step 1**: Add the right-most digits together. When the sum is more than 10, put the 1 in the dotted line carry box and the second digit in the unit box. Have your students practice this step a number of times. (For exercises with concrete materials, which will help your student understand why they carry, see Section NS1-4 of the Number Sense 1 unit.)

2. **Step 2**: After your students have done this carry step for all the exercises, they can go back and complete the summation.

The second page of BN-3A has similar exercises but no boxes are provided (so your student can practice lining up the numbers).

**BN-7B - Triple Digit Addition with Carrying**

In these exercises there is (usually) more than one carry operation to be performed. If your students have difficulty, remember to have them practice Step 1 over and over, and then go back and complete the question.
BN-8A – Single Digit Subtraction
Once again, the following technique is useful for students who have difficulty with single digit subtraction. It also provides great preparation for the patterns unit.

In contrast to addition, remind your student that we start with the smaller number (close fist) and count up to the larger number. The number of fingers displayed is the result.

Subtraction (Where the answer is a single digit)
Example: 11 – 8 =

Step 1: Say the lower number ("8") with your fist closed.

Step 2: Count up by ones, raising your thumb first, then one finger at a time until you have reached the higher number (11).

Step 3: The number of fingers you have up when you reach the final number is the answer (in this case you have three fingers up, so three is the difference between 8 and 11.)

A great bonus question would be double, or multiple digit subtractions whose difference is a single digit. We found that even grade 2 students get very excited about subtracting large numbers. The important point is to choose numbers whose difference is a single digit (e.g. 628-624).

BN-8B – Double and Triple Digit Subtraction
Some questions on this page would require borrowing if students were made to line up the numbers and subtract them by using the standard algorithm. However, since the answers in all these exercises are all less than 10 (i.e. single digits), students can still use the finger counting technique described in section BN-4A to solve the questions without borrowing. In the bonus questions, students subtract numbers in the millions! (The key to the students’ success? The numbers differ by less than 10!)

BN-9A – Double Digit Subtraction (No Borrowing)
In these exercises each digit is lined up and subtracted separately – no need for borrowing.

BN-9B – Multiple Digit Subtraction (No Borrowing)
These exercises provide more practice in subtraction without the need for borrowing.
BN-9C – Double Digit Subtraction with Gaps (No Borrowing)
On this page, the numbers to be subtracted may be of different lengths (i.e. different numbers of digits). Students get practice aligning these numbers correctly.

BN-10A – Multiple Digit Subtraction with Borrowing Once
Each problem on this page involves several steps, e.g. for problem a) 21-19:

Step 1: Notice that the last digit (unit) of the second number is greater than the first – so you cannot subtract without borrowing.
Step 2: Subtract (i.e. borrow) 1 from the tens digit of the first number. Since 2 – 1 = 1, cross out 2 and replace it with 1. Put the 1 borrowed in the “borrow” position (i.e. in the dotted box).
Step 3: Subtract 9 from what is now 11 (with the borrowed 1) and put the result (2) in the units place.
Step 4: Complete the subtraction in the tens space – 1 minus 1 is zero.

You may want to have your students practice each step separately, e.g. do Step 1 for all problems, then go back and do Step 2, etc.

BN-10B – Multiple Digit Subtraction (When do you borrow?)
Have your students write "Help" beside questions where the right most digit of the top number is smaller than the right most digit of the lower number. This exercise will force your students to think about whether or not they need to borrow before they start to subtract (i.e. wherever they have written "Help", they will need to borrow.)

BN-10C – Multiple Digit Subtraction with Borrowing Twice
For this section, students will need to borrow twice. Once again, you should instruct your students to practice each step separately.

BN-10D – Multiple Digit Subtraction with Borrowing from Zeroes
For this section, give your students some practice questions on a separate piece of paper before giving them the worksheet. Remind your students that they cannot subtract 1 from 0. Your student should recognize that in a question like 200 – 19 they cannot borrow from the tens column (as they normally would) because the tens column contains a 0. In this case your students will need to borrow from the hundreds digit. Have them borrow from the hundreds, to get a 10 in the tens column, then borrow from the 10 (which becomes a 9) to get a 10 in the ones (units) column. Have them practice this step repeatedly before going back and completing the questions.

NOTE: You can show your students why borrowing works with base ten materials: see Section NS1-4 of the Number Sense 1 unit.
BN-11A Word Problems
These word problems involve things and situations kids should be familiar with from their classroom. If your student has trouble with these questions, ask them:

a) What is being asked?
b) What do we know? For example, in question 2 we know two things
   1. There are 25 kids in the class.
   2. Kids can either have black hair or not. (Point out to your students that sometimes they will have to draw on things they know that are not explicitly stated in the question.)
c) How do we find the answer - How many kids do not have black hair.