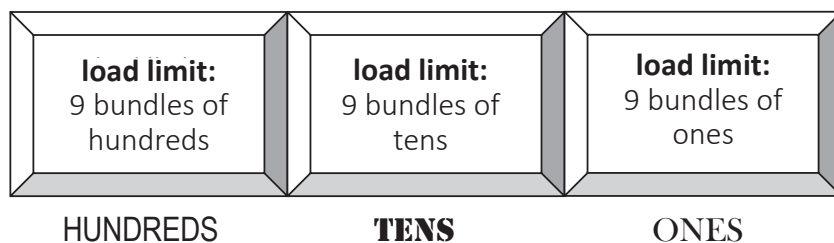


Get out the box cars you used to show the number trains. The reason box cars are so useful is that each box car connects in the same way. Once you know how to repackage a number in the ONES PLACE box car and carry it over to the TENS PLACE box car, you can work with any box car PLACE in the same way. The only thing that changes is the size of the bundles that are allowed in each box car. Do you remember that each PLACE VALUE box car can only have one digit in it? That means it can only have up to nine groups of whatever PLACE it is.



- The ONES PLACE can only hold up to nine ONES. If the sum of the digits in the ONES PLACE is 10 or more, we have to regroup.
- The TENS PLACE can only hold up to nine bundles of TEN. Ten bundles of ten is the same as 10 times 10, which is 100. That throws us into the next box car, the HUNDREDS. So if the sum of the digits in the TENS PLACE is 10 or more, we have to regroup.

Here is another story for you. *There are 47 people riding in one bus and 68 people riding in another bus. How many people are in both buses?*

First we need to write the vertical addition problem, being careful to line up the digits in the columns.

$$\begin{array}{r} 47 \\ + 68 \\ \hline \end{array}$$

Since we are adding larger numbers, let's make sure we can see what is happening in this story. Use the bundled and loose sticks to show the numbers. Start by showing the number of people in the first bus. How do you show the number 47?

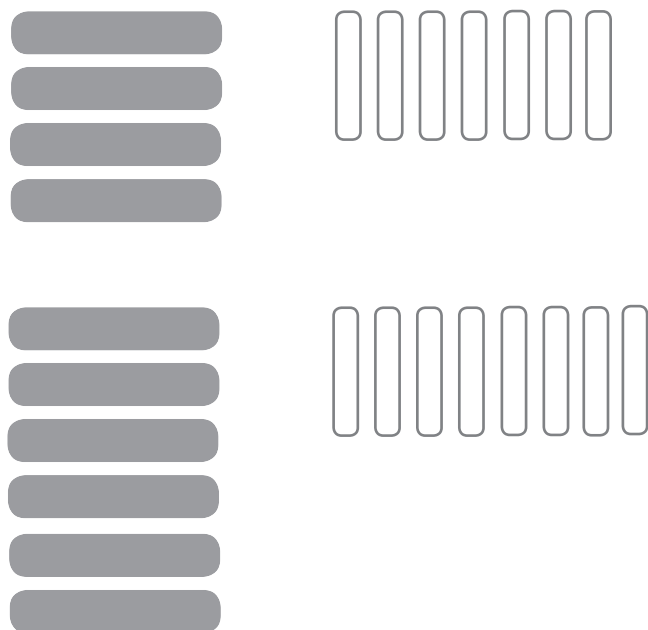


Do your sticks look something like this?



Now show the number of people in the second bus. Put the sticks under the ones you already have, keeping the bundles of TENS in the same column and the loose sticks in the same column. How do you show the number 68?


Yes, with six bundles of TEN and eight loose sticks. Do all your sticks together look something like this?



Now count how many loose sticks you have in all. 

Yes, 15. Can we have 15 sticks in the ONES PLACE?

No, the box cars remind us that we can only have up to 9 bundles of the correct size bundle in each PLACE. Since we are counting the ONES, we can only have up to 9 loose sticks in the box car. This means we have to regroup. How do we regroup the 15 sticks?

We see how many groups of TEN we can make. The number 15 in expanded form is $10 + 5$. Go ahead and stack ten sticks and wrap a rubber band around them. 

Now what do you have to do with this new bundle that is the overload from the ONES?

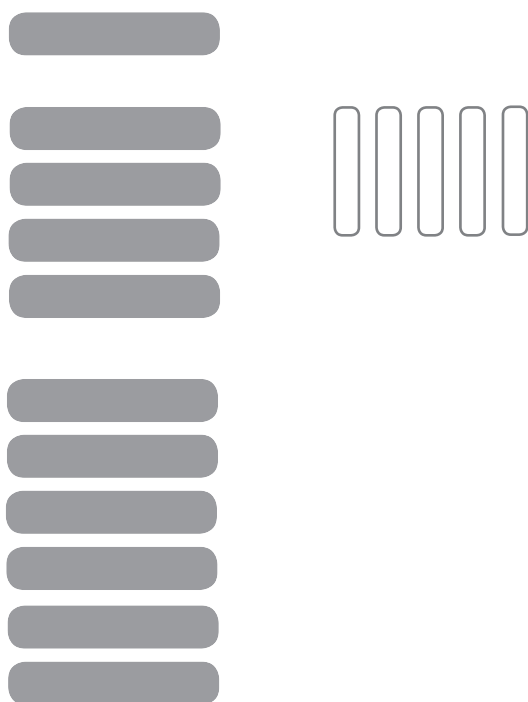
Yes, put it in the column with the rest of the TENS. As you do, can you see that you are “carrying” the bundle to the TENS PLACE? How many loose sticks are leftover in the ONES PLACE?

Yes, 5. Here’s how that looks in the vertical addition problem.

$$\begin{array}{r}
 \boxed{1} \\
 \begin{array}{r}
 47 \\
 + 68 \\
 \hline
 5
 \end{array}
 \end{array}$$

With the ONES PLACE taken care of, let's see what your sticks should look like now. Can you see the new bundle of TEN that was carried to the top of the TENS column?

When we work through arithmetic problems, we always start with the ONES place in case we have to regroup. We work from right to left, working with one PLACE at a time.



Can you guess what we need to do now?

If you said count the bundles in the TENS PLACE column, then pat yourself on the head with both hands. How many bundles of TEN do we have now?

Yes, 11. Oh dear, our TENS PLACE is overloaded! The TENS PLACE box car reminds us that we can only have up to 9 bundles of TEN. So now we have more work to do. We have to regroup the sticks again.

Since we are working with the TENS, we need to see how many groups of HUNDREDS we can make. Using skip-counting, count by TENS as you gather up bundles of TEN. Remember, you need 10 bundles of TEN to make a bundle of a HUNDRED. Go ahead and wrap a large rubber band around these bundles.



You now have 1 bundle of a HUNDRED. Of course this new bundle of a HUNDRED cannot stay in the TENS PLACE. There is no room for it! So we have to move it over to the HUNDREDS PLACE, carrying it over to the left.

With the new bundle in its correct place, how many bundles of TEN are left in the TENS PLACE?

Yes, 1 bundle of TEN. Your sticks should look something like this:



Here's how this looks in the vertical addition problem.

$$\begin{array}{r}
 \boxed{1} \boxed{1} \\
 \begin{array}{r}
 47 \\
 + 68 \\
 \hline
 15
 \end{array}
 \end{array}$$

The digits under the line show us the 1 bundle of TEN and the 5 loose sticks. But now we have a digit sitting above the HUNDREDS PLACE column. We cannot forget about it. We have to count it. Since there are no other digits in the HUNDREDS PLACE column from the numbers we started with, there is nothing else to add to it. There is only the 1 bundle of a HUNDRED that we carried. So all we have to do is write that digit under the line. What numeral does this show?

$$\begin{array}{r}
 \boxed{1} \boxed{1} \\
 \begin{array}{r}
 47 \\
 + 68 \\
 \hline
 115
 \end{array}
 \end{array}$$

Yes, 115. When we write that out in expanded form we get: $115 = 100 + 10 + 5$.

- Can you see that this matches the sticks in front of you? One bundle of a HUNDRED, one bundle of TEN, and five loose sticks.

When we need to add larger numbers, we have to:

- make sure we write the addition problem carefully so that all the digits line up in the correct PLACE VALUE columns.
- add the digits in each PLACE VALUE column to see if they go over 9, which means we have to regroup and carry over to the next PLACE VALUE column.
- include the numbers that are carried over when we add the digits in that PLACE VALUE column.