

MULTIPLICATION IN BASE 10 & 5

Multiplication is repeated addition. We can model 4×3 by making a 3 copies of a group of 4, then shoving them together to get 12.

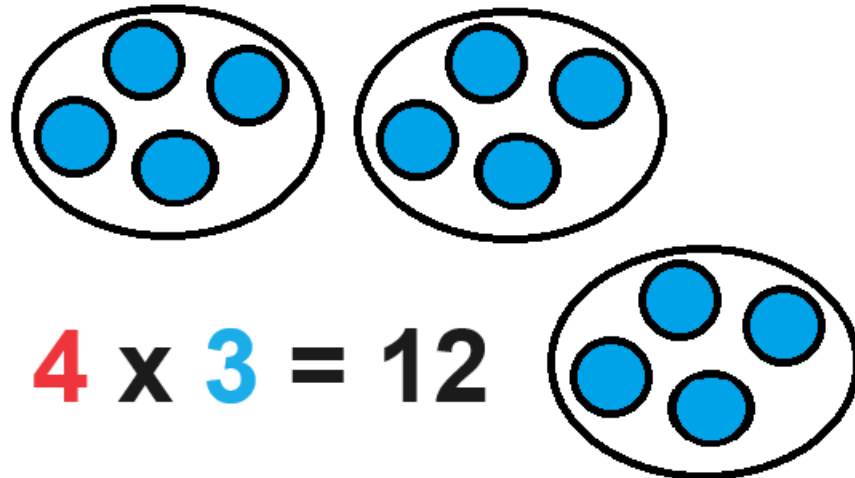


Figure 1: 4×3 using colored counters

When we move up to larger numbers, the concept is the same. If we use base 10 blocks, we can handle larger numbers.

Multiplication in Base 10

Consider 247×4 .

First, represent the numbers:

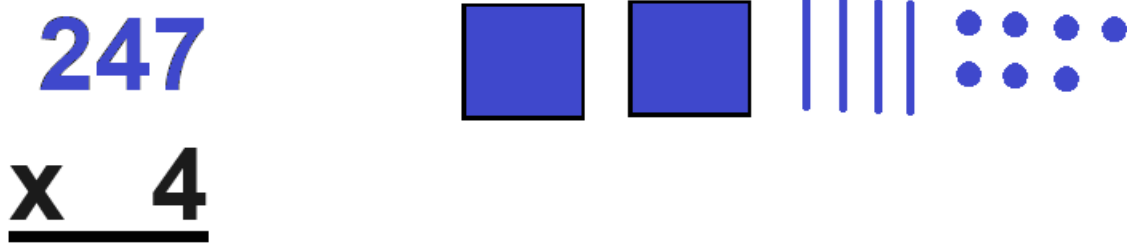


Figure 2: 247 represented with Base 10 blocks

Make 4 copies of your number. Then you have to start regrouping.

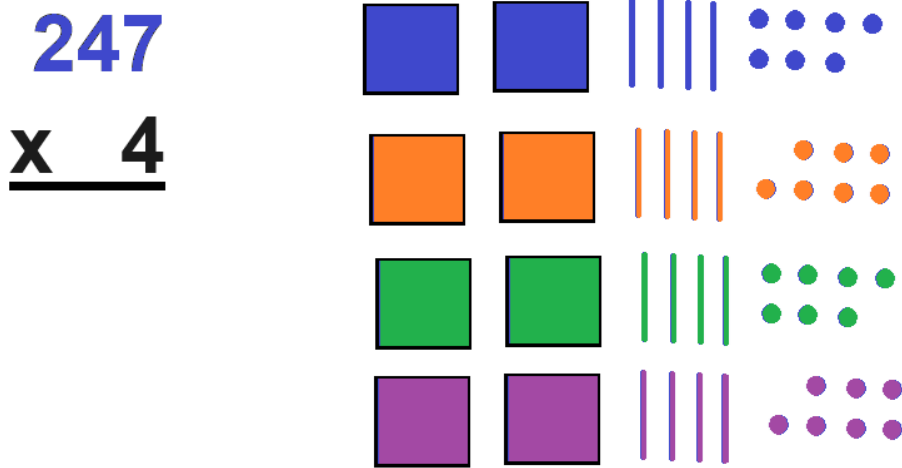


Figure 3: 4 copies of 247

Then, start regrouping, beginning with the units. We have a total of 28 units. We regroup sets of 10 into the next size block. 10 units = 1 long. So we “carry” 2 longs and keep 8 units.

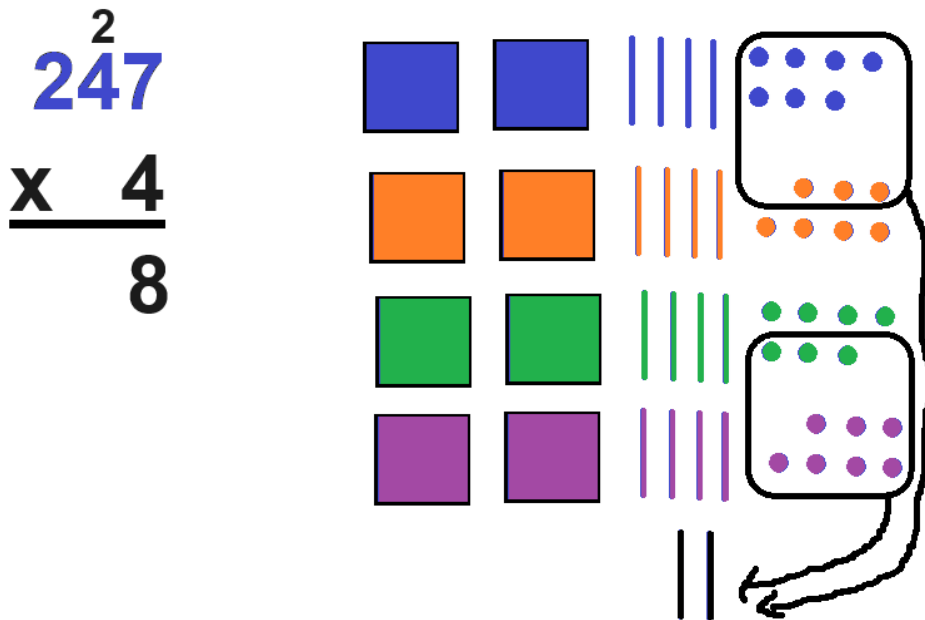


Figure 4: Collecting Units

Now we collect our longs. We have 16+2, or 18. Again, regroup sets of 10 into the next size. 10 longs = 1 flat. So “carry” a flat and keep 8 longs.

$$\begin{array}{r} \\ 247 \\ \times 4 \\ \hline 88 \end{array}$$

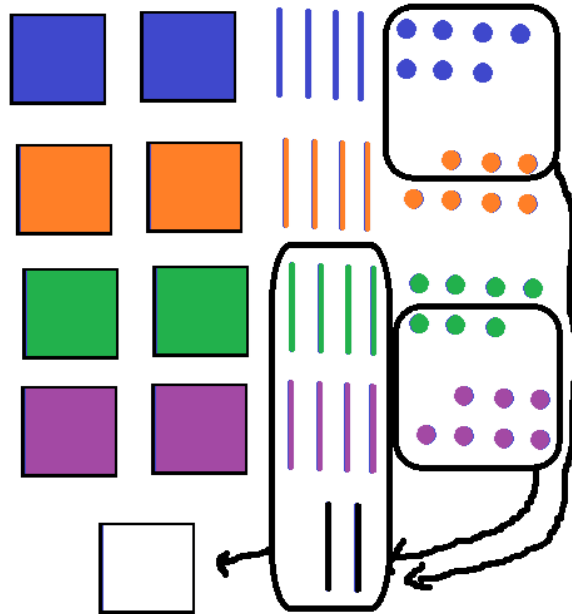


Figure 5: Collecting longs

Finally, combine our flats. We have 8 + 9, or 4 flats. This is less than 10 so we don't need to regroup.

$$\begin{array}{r} \\ 247 \\ \times 4 \\ \hline 988 \end{array}$$

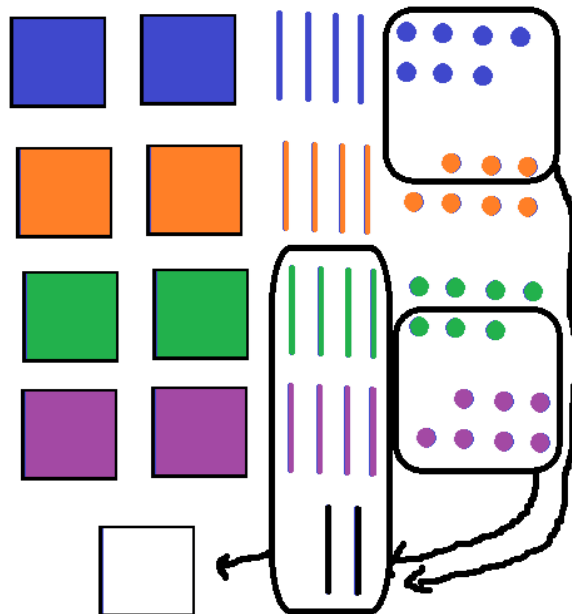


Figure 6: Collecting flats

The process is the same, even if there are more place values. In the model, we group sets of 10 (or 5) and trade up for the next size block. When we write down the problem, this trade up is what we carry, and we write down the number of blocks after the regrouping.

Multiplication in Base 5

Multiplication in Base 5 works the same way; all that changes is that we regroup sets of 5 instead of sets of ten.

Consider **243 x 3 (base 5)**:

First, represent your number.

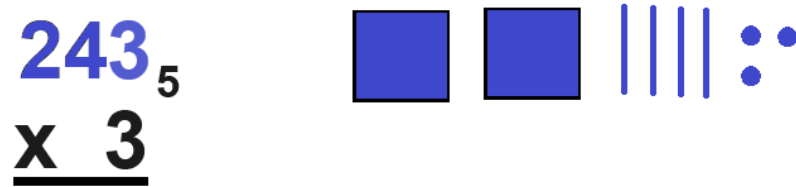


Figure 7: 243 (base 5) represented with Base 5 blocks

Next, make 3 copies of the number.

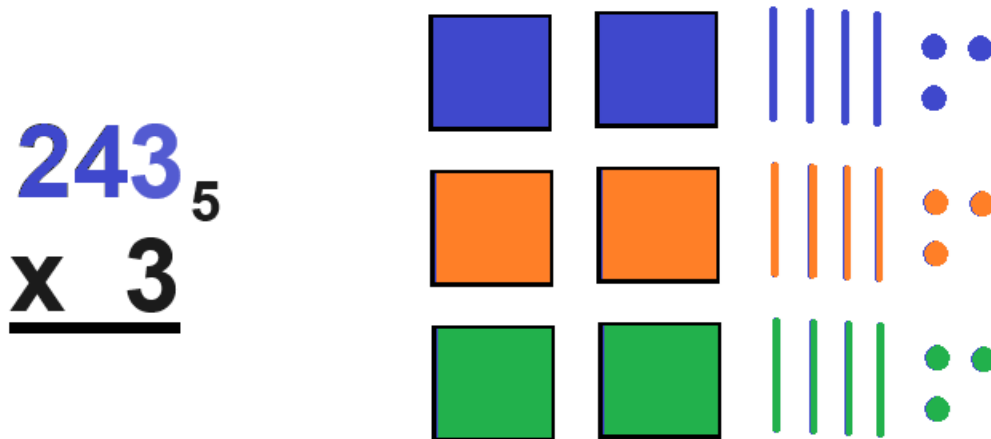


Figure 8: 3 copies of 243 (base 5)

Next, start regrouping. Remember that we're in base 5, so we want to trade in groups of 5. Starting with units, I have 9 units. Trade in 5 units for 1 long. So "carry" a long and keep 4 units.

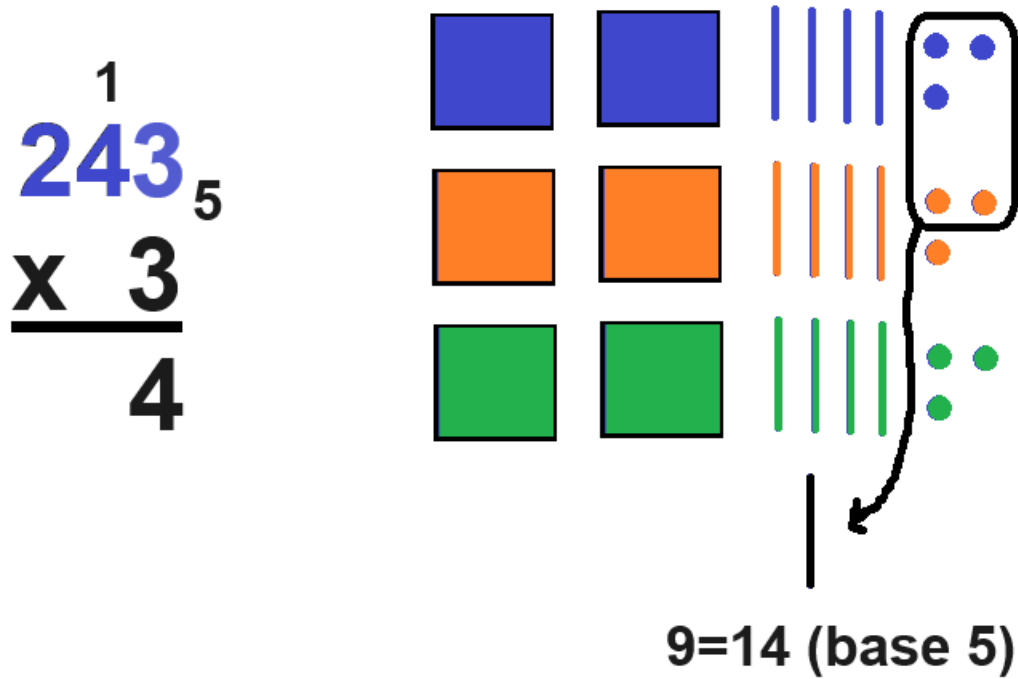


Figure 9: 243-154. Collecting units

Now combine longs. We have 13 longs. Trade in 5 long for 1 flat. So we carry 2 flats and keep 3 longs.

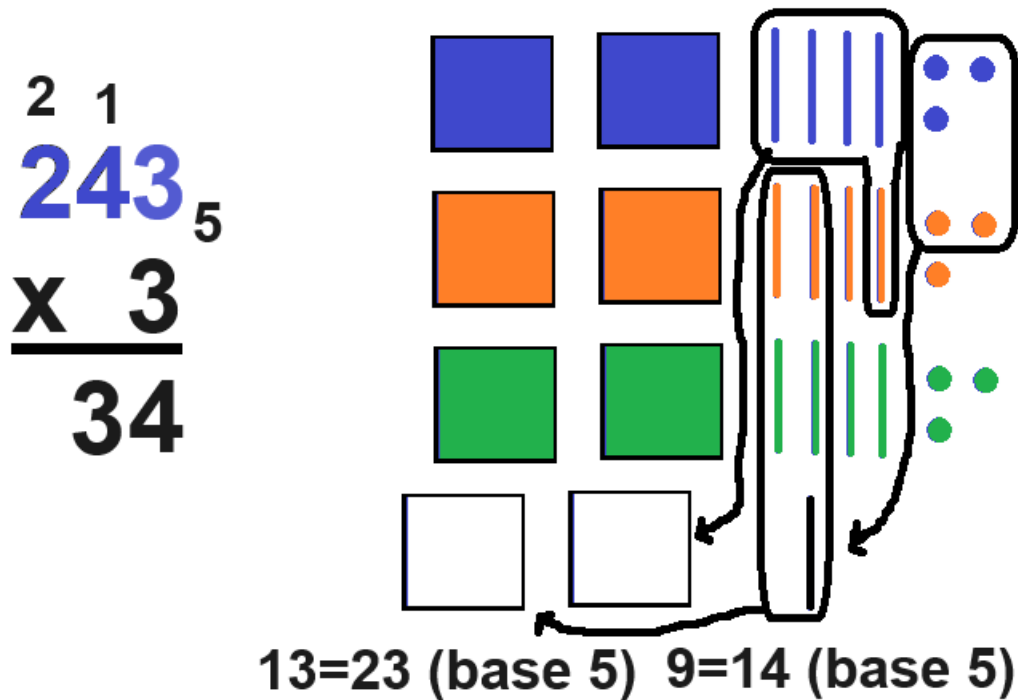


Figure 10: Collecting longs

Finally, combine the flats. We have 8 flats. Trade in 5 flats for one cube. Carry 1 cube and keep 3 flats.

Figure 11: Regrouping and subtracting longs

Finally, we want to take away one long. We have one, so we subtract and have none left.

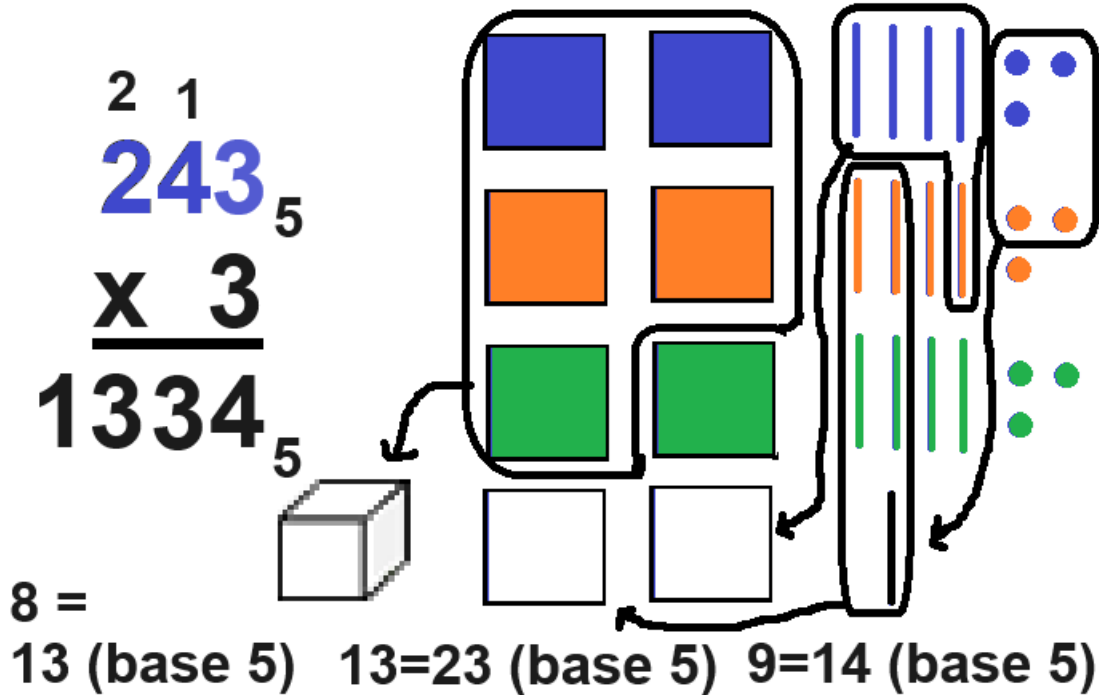


Figure 12: Collecting flats

Of course, you would do a lot of examples with models before expecting students to be able to do them on their own. The goal is eventually to be able to do without the model, but the model builds conceptual understanding of what's really going on when we regroup ("borrow" or "carry"). If you forget how to use the algorithm, you can still figure it out if you have the model and conceptual understanding as a foundation.