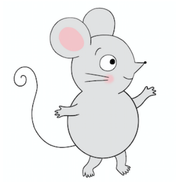
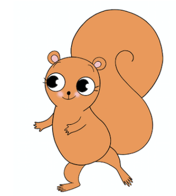
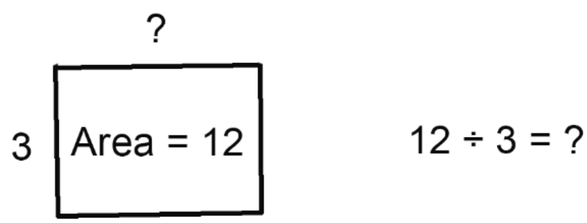


Array/Area Model for Division

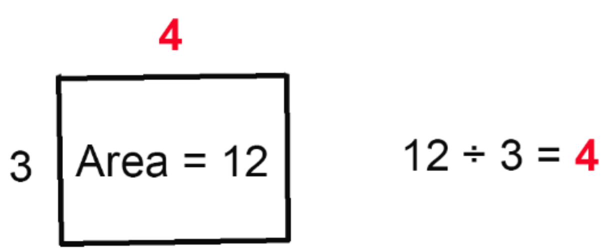


Here's another method for long division you might be asked to do. In some ways, it's very similar to the "Zeros Show Below" method of long division on p. 212 of *The Times Machine*, but it uses boxes instead of a dividing house.

The reason this is sometimes called the Area Model is because we can think of the dividend as the *area* of a rectangle. After all, to find the area of a rectangle with sides 3 and 4, we'd multiply 3 X 4 to find that the area is 12, right? Instead, if we'd first been told the area of a rectangle is 12 and that one of the sides is 3, we could do **12 ÷ 3 =** ? to find the other side's length.

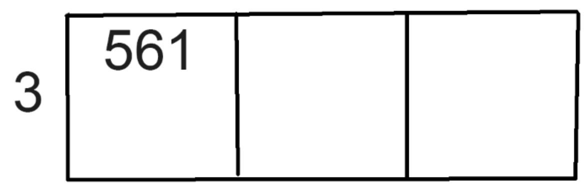


And we get **12 ÷ 3 = 4:**



In this division problem, the area (12) is the dividend, see? Okay, back to the method!

Let's try the problem we did on p. 212, which is **561 ÷ 3 = ?**, so you can see how similar this method is to the "Zeros Show Below" method. We'll start by drawing some boxes. How many boxes? Just count the number of digits in the dividend! Counting the 5, 6 and 1, we see there are three digits, so we'll draw three boxes. Next, we'll write the divisor, 3, to the left of the boxes and the dividend, 561, inside the first box (and leaving space below it). Note: We might not need three boxes, but we definitely won't need *more* than three boxes – it's okay if we draw more boxes than we need, after all!



(Looks a little like we are saying the area of this rectangle is 561 and one side is 3, right?)

Next, we'll use some steps! They are:

1. Divide

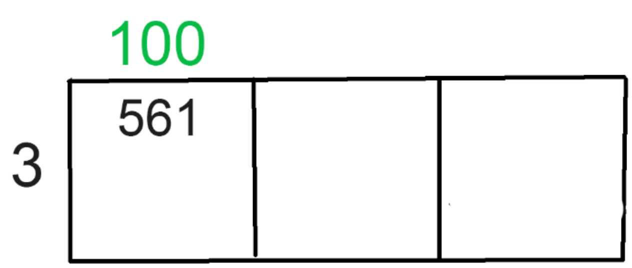
2. Multiply

3. Subtract

4. Bring Over

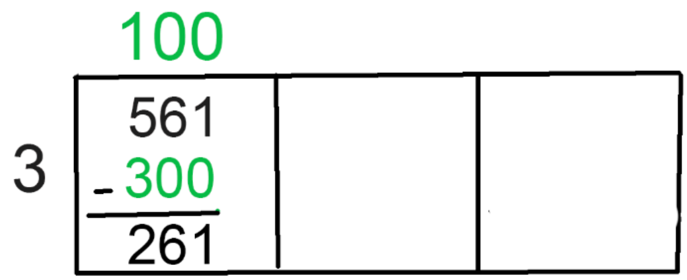
Step 1. Divide!

Very similar to the step-by-step explanation of long division on p.210-211 of *The Times Machine*, we start by looking at only the first digit of the dividend and ask, "How many times does 3 go into 5? Well, 3 X 1 = 3 and 3 X 2 = 6, so we know that 3 goes into 5 just **1** time. So, we write the **1** above, being careful to write it directly above the 5 since that's what we just divided into. Since the **1** is really in the hundreds place over that 5, we know that the **1** is really 100, so we'll add those two zeros to it, so **100** is now written above the box.

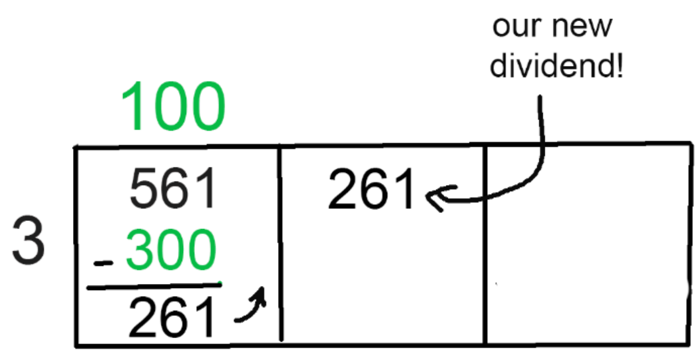


Step 2. Multiply! We multiply 3 X 100 = **300**, and write that below the dividend, 561.

Step 3. Subtract! We subtract 561 – 300 = **261**.

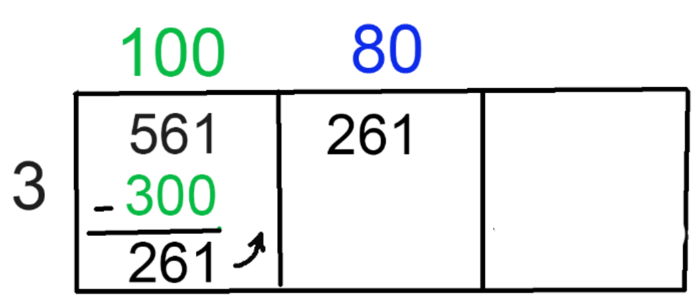


Step 4. Bring over! We bring that **261** over to the next box. That's our new dividend!



And now we do the steps again, using the 261 as our dividend, and for now, we can totally ignore that first box.

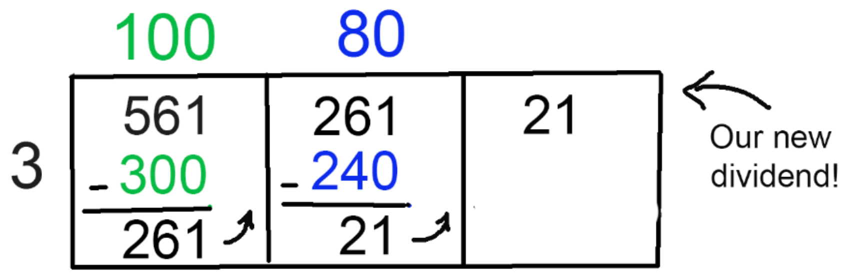
Step 1. Divide! Looking at the first digit of our dividend (in the second box) to begin: How many times does 3 go into 2? None! Well then, how many times does 3 go into 26? Hmm, since 3 X 8 = 24 but 3 X 9 = 27, we can see that 3 goes into 26 just **8** times. Great! So we'll write the 8 above the box, careful to line it up with the 6, the last digit of the 26 we just divided into. Since that **8** is in the tens digits over the 6, we know it's really **80**, so we'll fill in that zero.



Step 2. Multiply! We just multiply 3 X 80 = 240 and write that underneath our (new) dividend, 261.

Step 3. Subtract! We subtract 261 – 240 = **21**.

Step 4. Bring over! We bring the **21** over to the next box, and now that's our new dividend – the only part that's left to divide up!

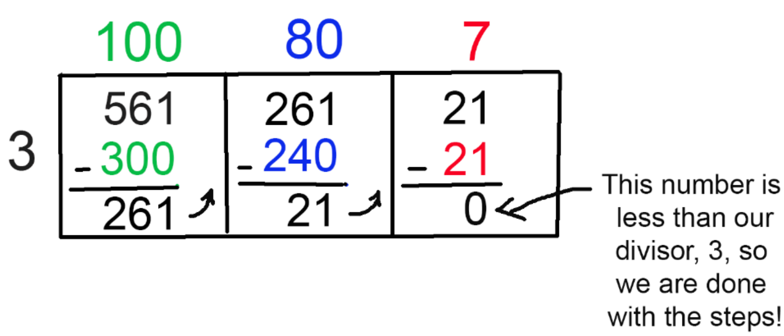


Okay, time for our steps again!

Step 1. Divide! As always, we look at just the first digit of the new dividend (21). So how many times does 3 go into 2? None! Then, how many times does 3 go into 21? Actually, it goes in exactly **7** times, since 3 X 7 = 21. Fantastic! So we'll write the **7** up top, directly over the 1, the last digit in the 21. (Since the 7 is in the ones place, and not tens or hundreds, we don't have to add any zeros to it.)

Step 2. Multiply! We multiply 3 X 7 = 21, and write that 21 under the dividend (also 21!).

Step 3. Subtract! We subtract 21 – 21 = **0**. Since 0 is less than our divisor, 3, we are done with the steps.



And to get our final answer, we just add up the stuff along the top: 100 + 80 + 7 = **187**. (By the way, if that 0 had been a 1 or 2, that would be our remainder.)

We have learned that **561 ÷ 3 = 187**; great job!

And if you think about it, that rectangle with an *area* of 561 and one side measuring 3, yep, would totally have its other side measuring 187 – that's a pretty long, skinny rectangle!

What we have created here (if you ignore all the subtraction problems inside the boxes!) looks a little like the Box Picture method of *multiplication* that we learned back on p. 178 in *The Times Machine*. Try this Array/Area division method we've just learned on the problem 584 ÷ 3 = ? and see if the boxes you draw re-create something like the image on p.178 by the end of the problem! (But no peeking at that page until you do the problem!) ;)

Great job!