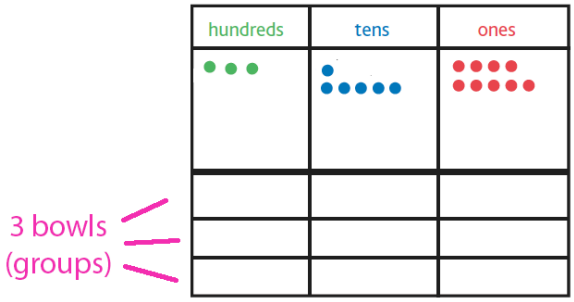
Here are the worked-out solutions to some of the trickier problems from the last chapter in *The Times Machine*. I hope you find them helpful!

**From the Game Time on p. 204:**

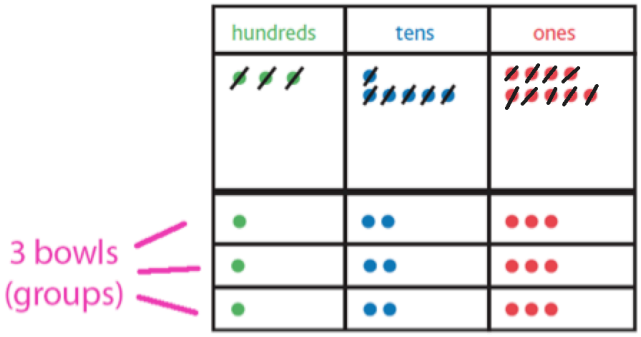
By the way, for these problems, sometimes I'll call disks "dots" instead. They mean the same thing here!

2. 369 ÷ 3 = ?

First, we set up our place value chart, with 369 written as disks, and 3 bowls to divide it into, since we're supposed to divide this by 3, after all!



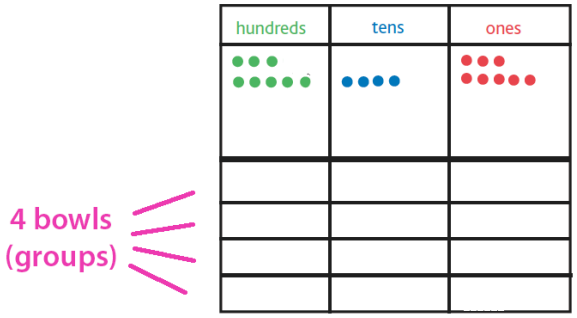

Then, we ask ourselves, can we divide those 3 green dots among 3 bowls? Yep! 1 each will go into our 3 bowls. And then we cross off the green dots at the top of the chart. Can we divide those 6 blue dots among 3 bowls? Yep! 2 each will go into our 3 bowls. And then we cross off the blue dots at the top of the chart. Can we divide those 9 red dots among 3 bowls? Yep! 3 each go into the 3 bowls. And then we cross off the red dots at the top of the chart. No regrouping was needed here, but we need to cross off the dots we use each time (The answer key of the book really should have had the 9 red dots crossed off for this problem, just like the green and blues dots are crossed off – it was a typo!).



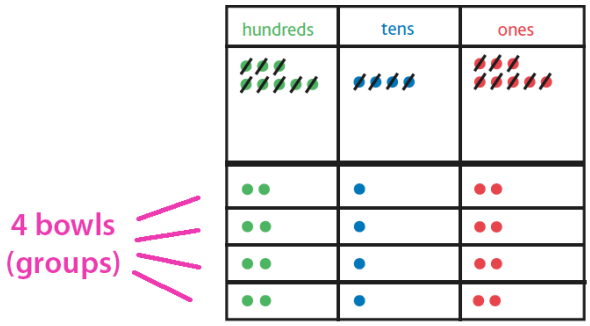

And now we can see that in each bowl we have 1 hundred, 2 tens and 3 ones, in other words, 123. So 369 ÷ 3 = **123**. Done!

3. 848 ÷ 4 = ?

First, we set up our place value chart, with 848 written as disks, and 4 bowls to divide it into, since we are dividing by 4:



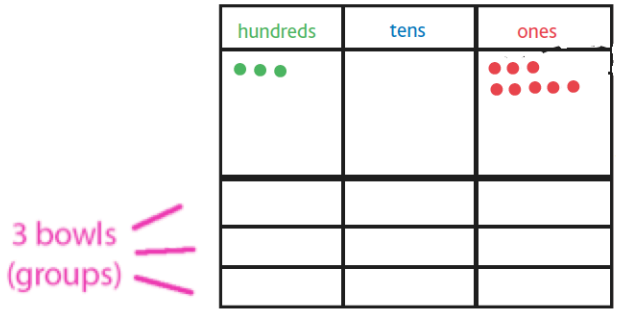

We're dividing 848 ÷ 4, right? Now it's time to divide those disks among our 4 groups (bowls!). So we ask ourselves, can we divide those 8 green dots among 4 bowls? Yep! 2 each will go into our 4 bowls. Can we divide those 4 blue dots among 4 bowls? Yep! 1 each will go into our 4 bowls. Can we divide those 8 red dots among 4 bowls? Yep! 2 each go into the 4 bowls. No regrouping was needed here, and be sure to cross off the dots we've used:



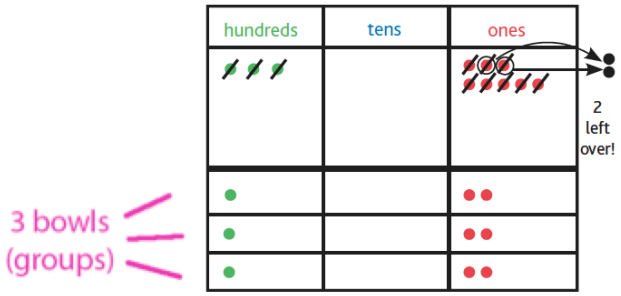

And so we see that each group has 2 hundreds, 1 ten and 2 ones, in other words: 212. So we've discovered that 848 ÷ 4 = **212**. Done!

4. 308 ÷ 3 = ?

First, we set up our place value chart, with 308 written as disks, and 3 bowls underneath to divide it into, since we are dividing by 3. Notice that there won't be any disks in the tens column since we have 0 tens:



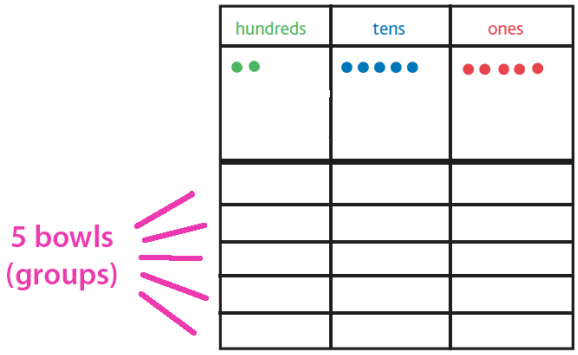

So we ask ourselves, can we divide those 3 green dots among 3 bowls? Yep! 1 each will go into our 3 bowls. Nothing to do in the tens column. Can we divide those 8 red dots among 3 bowls? Yep! 2 each go into the 3 bowls, and we'll have 2 left over (since 8 ÷ 3 = 2 R2). No regrouping was needed here, but we need to cross off the dots we've used each time:



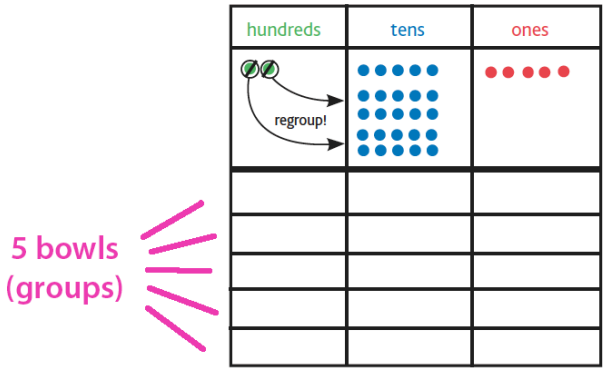

So we can see that in each of the 3 groups, we have 1 hundred, no tens, and 2 ones, in other words: 102. And don't forget the 2 ones disks that were left over! So that means 308 ÷ 3 = **102 R2**. Done!

5. 255 ÷ 5 = ?

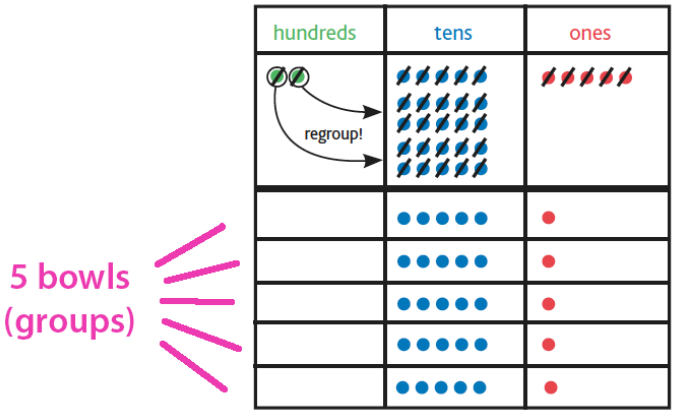
First, we set up our place value chart, with 255 written as disks, and 5 bowls underneath to divide it into, since we are dividing by 5.



So we ask ourselves, can we divide those 2 green dots among 5 bowls? Well, no! So we need to regroup those 2 hundreds into 20 tens, being sure to cross off the hundreds once we regroup them. Notice that we now have a total of 25 blue dots in the tens column that we'll be dividing up:



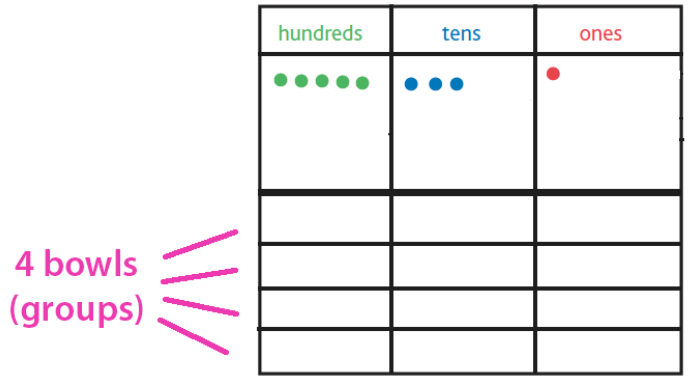

Now that the disks in the hundred column are crossed off and regrouped, we ask: Can we divide those 25 blue dots among 5 bowls? Yep! 5 each will go into our 5 bowls. Can we divide those 5 red dots among 5 bowls? Yep! 1 each go into the 5 bowls. All the dots at the top of the chart have been crossed off, which means they've all been divided up!



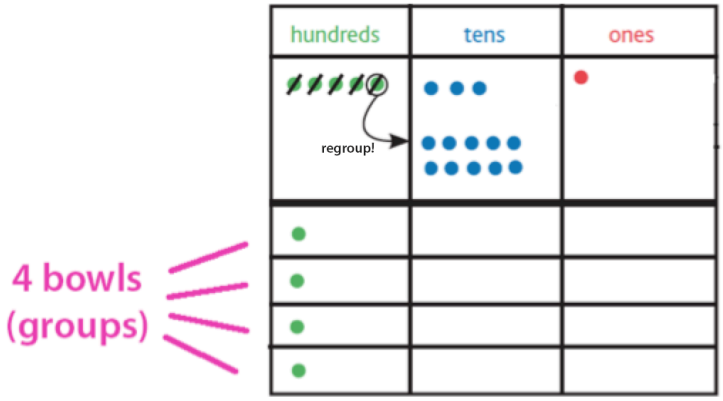

And now we can see that in each group, there are 5 tens and 1 one, in other words: 51. So we've discovered that 255 ÷ 5 = **51**. Done!

6. 531 ÷ 4 = ?

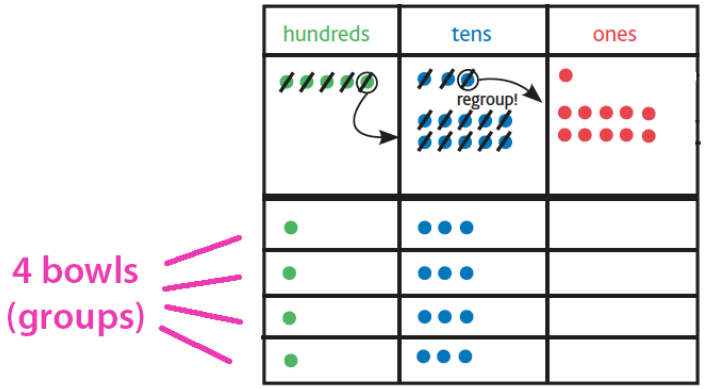
First, we set up our place value chart, with 531 written as disks, and 4 bowls underneath to divide it into, since we are dividing by 4.



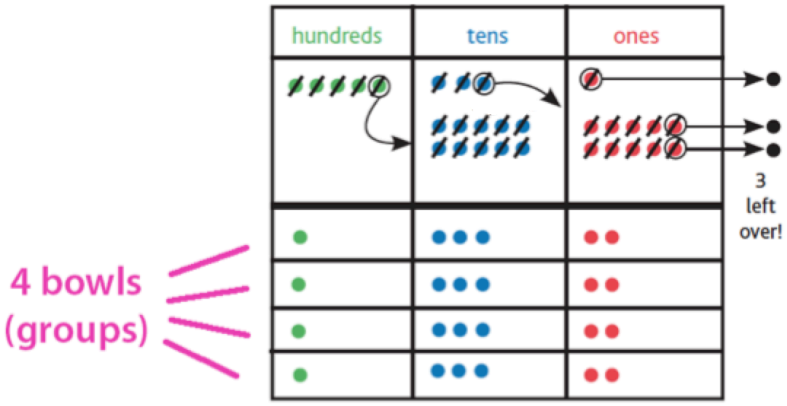

Next we ask, can we divide up the 5 green dots among the 4 bowls? Yes! 1 green dot can go in each bowl. But we'll also end up with an extra green dot, right? So we'll have to regroup the one green hundreds disk into 10 blue ten disks. No problem!




Next, we ask: Can we divide up the 13 blue dots among the 4 groups? Yep!
Since 13 ÷ 4 = 3 R 1, we'll be able to put 3 blue dots in each group, and we'll have to regroup one blue ten dot into 10 red ones dots:



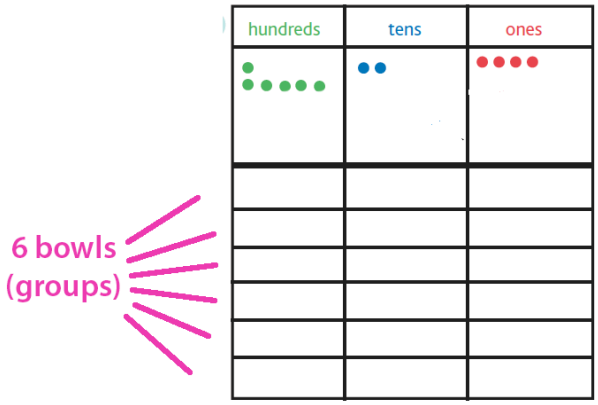
Making good progress! Finally, we can divide those 11 ones into the 3 bowls. Since 11 ÷ 4 = 2 R 3, we'll end up with 2 red dots in each group, and 3 left over:



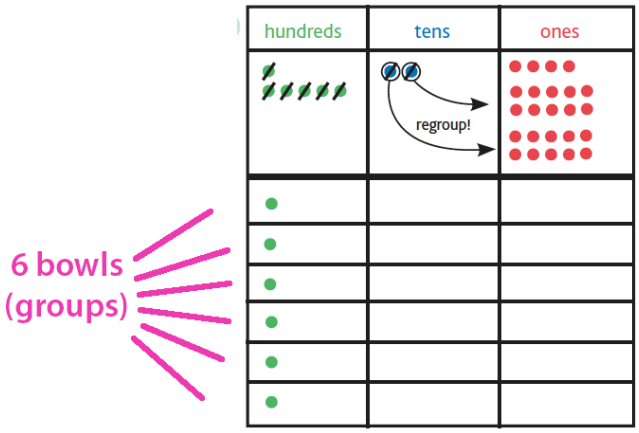

We can see that each group has 1 hundred, 3 tens and 2 ones. And 3 left over! So we've discovered that 531 ÷ 4 = **132 R3**. Great job!

7. 624 ÷ 6 = ?

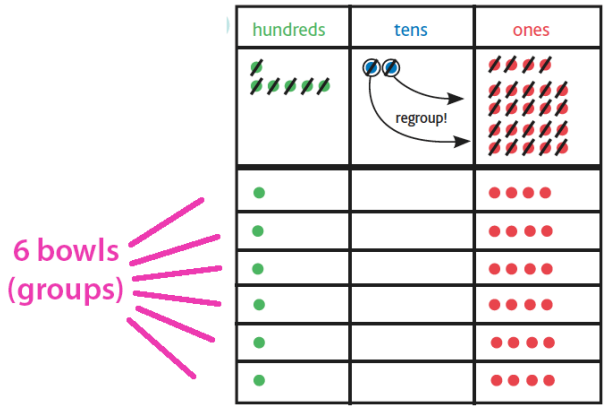
First, we set up our place value chart, with 624 written as disks, and 6 bowls underneath to divide it into, since we are dividing by 6.




Next we ask, can we divide up the 6 green dots among the 6 bowls? Yes! 1 green dot can go in each bowl. Now we ask, can the 2 blue dots be divided up among the 6 bowls? Nope! So we can regroup those 2 blue ten disks into 20 red disks. Notice that we now have a total of 24 red disks:



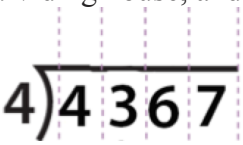

Now that the green and blue dots have been crossed off up above, we ask: Can the 24 red dots be divided among the 6 groups? Yep! 4 red dots can go in each group. And there are none left over, so we're done distributing dots!



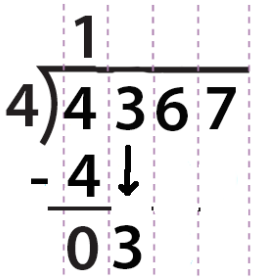

In each group, we see 1 hundred dot, no tens dots, and 4 ones dots, in other words: 104. And there were no leftovers, so we have discovered that 624 ÷ 6 = **104**. Done!

**Last few problems from the Game Time on p. 214:**

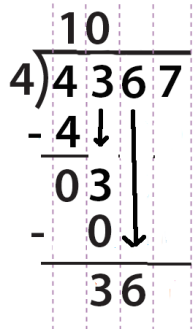
17. 4,367 ÷ 4 = ? *(I recommend you read #18's solution before this one. This particular problem has a lot of coincidences that could be misleading for how these problems usually go!)*

First we rewrite this with a dividing house, and we can draw in little place value (freeway) lines if we want! 

Let's use the steps from p.210.
**Step 1. Divide!** Yep, 4 goes into the 4 of "4367" 1 time, so we write the 1 directly over the 4 in the dividend.
**Step 2**. **Multiply!** We multiply the divisor (4) times the 1, and get 4 X 1 = 4, and we write the 4 directly under the 4 in the dividend.
**Step 3. Subtract!** We now subtract 4 – 4 = 0 and write that below.
**Step 4. Bring down!** We bring down the next digit in the dividend (3), so we can divide up the next chunk.

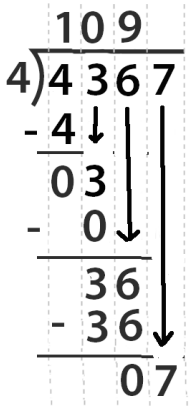


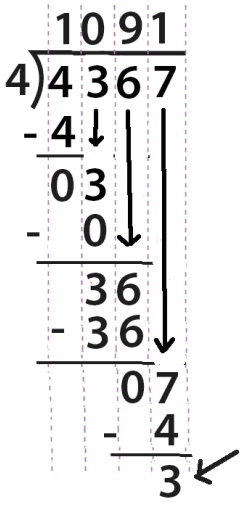

And now we start the process again, using 03 as our "new" total to divide up.




**Step 1. Divide!** How many times does 4 go into 3? Well, 0 times! So we write the 0 up above.
**Step 2: Multiply!** We multiply the divisor (4) times the 0 and get 4 X 0 = 0 which we write below.
**Step 3: Subtract!** We subtract 3 – 0 = 3.
**Step 4: Bring down!** Next we bring down the 6 and now 36 is our "new" total to divide up.

Time for our steps again!
**Step 1. Divide!** How many times does 4 go into 36? Well, exactly 9 times, actually! So we write the 9 up top.
**Step 2. Multiply!** We multiply the divisor (4) times the 9 and get 4 X 9 = 36, which we write below.
**Step 3: Subtract!** We subtract 36 – 36 = 0 and write that below.
**Step 4: Bring down!** Next we bring down the 7 and 07 becomes our "new" total to divide up.



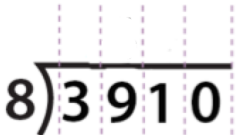




Time for our steps again ! (Pant, pant! Almost done!)
**Step 1. Divide!** How many times does 4 go into 7? 1 time! So we write the 1 up above.
**Step 2. Multiply!** We multiply the divisor (4) times the 1 and write it below.
**Step 3. Subtract!** We subtract 7 – 4 = 3.
**Step 4: Bring down!** But wait – there's nothing left to bring down, so that's our remainder.

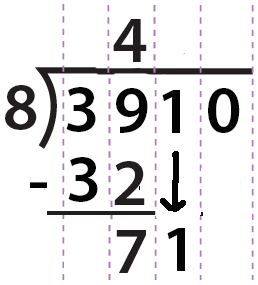
And we've discovered that 4367 ÷ 4 = **1091 R3**.
Nice work!

18. 3910 ÷ 8 = ?

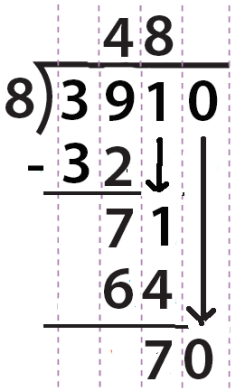
First, we'll write it as a dividing house with optional place value (freeway!) lines:




Let's use the steps from p.210.

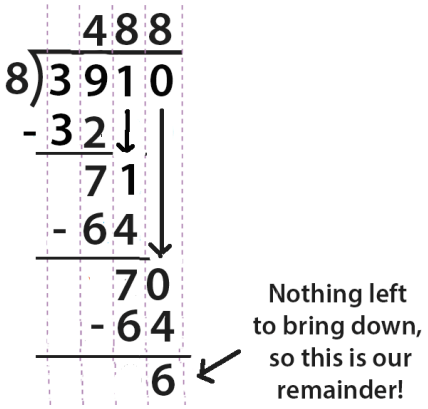



**Step 1. Divide!** Does 8 go into 3? Nope. Does it go into 39? Yep! Hm.. 8 X 4 = 32 and 8 X 5 = 40, which is too much, so we know 8 goes into 39 just 4 times. We write the 4 up top, over the 9 in 39, since we're dividing 8 into 39 and not 3. That's very important!
**Step 2. Multiply!** Next we multiply the divisor (8) times the number we just put up top, 4, and get 8 X 4 = 32, which we write underneath the 39.
**Step 3. Subtract!** We subtract 39 – 32 = 7.
**Step 4. Bring down!** We bring down the next part of the dividend to divide up, the 1. And now 71 has become our "new total" to divide up.




Time for the steps again!
**Step 1. Divide!** How many times does 8 go into 71? Well, 8 X 8 = 64, and 8 X 9 = 72. So close, but 9 doesn't work. We need to use 8! So since 8 fits inside 71 8 times, we write the 8 up top.
**Step 2. Multiply!** We multiply the divisor (8) times the number we just put on top, also 8, and get 8 X 8 = 64 and write that below the 71.
**Step 3. Subtract!** We subtract 71 – 64 = 7.
**Step 4. Bring down!** We bring down the 0 and now our "new total" to divide up is 70.

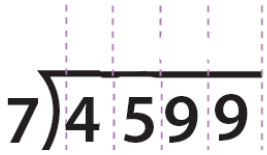
Just one more round of steps.
**Step 1. Divide!** How many times does 8 go into 70? Well we just saw that 8 X 8 = 64 and 8 X 9 = 72, so 9 is too big again, and we know that 8 goes into 70 just 8 times. So we write the 8 up top.
**Step 2. Multiply!** We multiply the divisor (8) times the number we just put on top, 8, and we get: 8 X 8 = 64. We write that below the 70.
**Step 3. Subtract!** We subtract 70 – 64 = 6. Since there are no more numbers in the dividend to bring down for Step 4, we are done, and the leftover 6 is our remainder!
We've discovered that 3910 ÷ 8 = **488 R6**. Nice job!



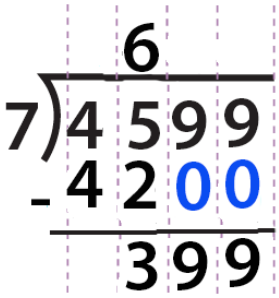
19. 4599 ÷ 7 = ?

Just for fun, we'll do this one with the "Zeros Show Below" method I showed you on p. 212 of *The Times Machine*. Remember, the steps are a little different now! But what I like about this method is that you're always looking at the full new total that's going to be divided up – you're not leaving anything up in the original dividend. Let's do it!

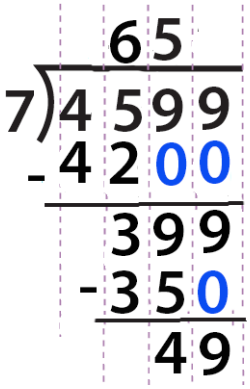
First, we rewrite this with a dividing house, with optional place value (freeway!) lines:




Next, we'll do our "Zeros Show Below" steps!
**Step 1. Divide!** Does 7 go into 4? Nope. Does it go into 45? Yep! How many times? Well, 7 X 6 = 42 and 7 X 7 = 49, so we know 7 fits inside 45 just 6 times. We'll write the 6 up top, directly over the 5 in "45" since we're dividing into 45 (and not just 4). *If you write the 6 on top of the 4, you could get the wrong answer!*
**Step 2. Multiply!** We multiply our divisor (7) times the number we just put on top, 6, and we get 7 X 6 = 42. We write that below the 45.
**Step 3. Fill in zeros!** Now we fill in the zeros to the right that will fit directly below our dividend. In this case, there are two digits left in the dividend that normally we'd be bringing down at some point in this process, but with the Zeros Show Below, we fill in those spots with zeros instead!




**Step 4. Subtract!** Now we can subtract those two big numbers: 4599 – 4200 = 399. And what we're left with is the full new total for us to divide up, 399. We'll never use that 4599 number again. In fact, you could even cross it off if you wanted!



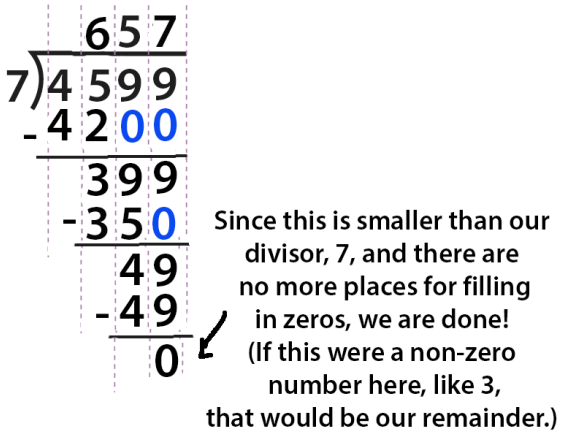

Time for the steps again!
**Step 1. Divide!** Now we treat the 399 like the original dividend, so we first ask: Does 7 go into 3? Nope. Does 7 go into 39? Yep! How many times? Well, 7 X 5 = 35 and 7 X 6 = 42, which is too big, so we know that 7 goes into 39 just 5 times. We write the 5 up top.
**Step 2. Multiply!** We multiply the divisor (7) times the number we just put up top, 5, and get 7 X 5 = 35. We write that below the 39.
**Step 3. Fill in zeros!** Looks like we just have one spot to fill in a zero, so let's do it!
**Step 4. Subtract!** We subtract the 399 – 350 = 49.

Time for the steps again! By the way, in case you were wondering if this is our remainder since there's nothing else to bring down? Don't confuse these steps with the normal steps

we learned on p.210. In this Zeros Show Below method, you know you're done when the subtraction gives you something smaller than the divisor AND there are no more spaces to fill in with zeros. Since 49 is bigger than 7, we know we're not done dividing it up into 7 parts!

**Step 1. Divide!** How many times does 7 go into 49? Well, 7 X 7 = 49 exactly! So we write the 7 up top.

**Step 2. Multiply!** We multiply the divisor (7) times the number we just put up top, 7, and we get: 7 X 7 = 49, which we write below.




And lookie there, since there is no more space under the original dividend (4599) for filling in zeros, and since this leftover number 0 is smaller than 7, we are done! (If there were a non-zero number 1-6 from this last subtraction, that would be our remainder.)

And we've discovered that 4599 ÷ 7 = **657**. Nicely done!