Column methods we use at St Barnabas

Calculating with Big Maths

Division

Step 1

$$\begin{array}{r|l} & \;23 \\ \cline{2-2} 3 & \;69 \end{array}$$

This step introduces the children to division using the layout sometimes known as the ‘bus-stop’.

Children should be taught this step after ‘Basic Skills: Division: Step 19’ which provides the understanding to underpin this column method division generally.

As with that step, the assumption here is that children know the relevant tables that they need with no hesitation (in this case x2,3,4,5).

Here, to begin with there are no remainders in the answer, although it is useful that children have already come across remainders in their high-understanding division steps since this adds ability and confidence to make this step easy. Hence, the new learning is just the skill of going along the columns and developing the verbal rhythm that goes with it, "Fours into 8 go 2, fours into 4 go 1."

Not only are there no remainders in the answer at this first step, there are also no remainders inside the question, i.e. as children move along the columns they find that the number divides perfectly e.g.

$2\overline{)\,48}$

$3\overline{)\,96}$

$4\overline{)\,84}$

$5\overline{)\,55}$

Step 2

$$\begin{array}{r} 27 \\ 3\overline{)\,8^{2}1} \end{array}$$

This step provides a slight progression as now there are remainders inside the question. This means we may, for example, need to divide 3 into 8 when addressing the tens digit and use the remainder of 2 as a mini tens digit for the units column as in the example shown here.

Since there are no remainders in the overall answer at this step, this means when the child now addresses the units column (with mini tens digit) they find that it divides perfectly. Further example questions include:

$$2\overline{)\,52}$$

$$4\overline{)\,76}$$

$$5\overline{)\,75}$$

We can see that, as with subtraction, the high-understanding explanation of what is really happening is possible but is unnecessary as it is long winded and the entire premise of Column Methods is that we have sacrificed some understanding for speed.

All the more important then that children have come through the high-understanding steps of the division Progress Drive in CLIC before arriving at this moment. At a more practical level this also means that children will have already secured the ability to know instantly all the answers and remainders as they move along the two columns (a skill gained at ‘Basic Skills: Division: Step 17’).

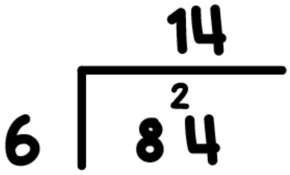
It is very useful to now take a slight digression before moving on. Introducing 3d divided by 1d and then 4d divided by 1d (for both, still just keeping to the x2,3,4,5 tables), will lead to building up the verbal rhythm of moving along the columns, as well as mastering these mini steps of progression.

The key teaching philosophy at this stage is to not to race on too quickly but to allow children to become fluent and efficient in the overall process of short column method division.

However, some teachers may also choose to introduce remainders in the answer at this point even though, as a skill, it is not officially ‘ticked off’ until Step 6 here.

And, if so, this could also be extended to ask children to think about contexts where the remainder is meaningful (see Step 7 here) if they are ready to grasp such a concept easily.

Step 3



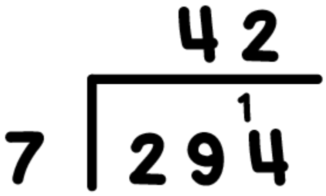
Now we begin 3 steps of progression that are typically covered quite quickly (Step 3, Step 4 and Step 5).

The slight shift now is that children have completed their 'Learn Its' journey from CLIC and now have instant recall for all of their 1d x 1d table facts. This means that we can now expect children to apply the same skills of column method division, already mastered, to questions where we are dividing by 6, 7, 8 and 9.

Obviously it would be useful to keep building up division proficiency with a lag behind tables proficiency, i.e. children should start dividing by 6 once they have total recall of their 6 times table (and related switchers and Fact Families) rather than waiting for them to know all of their x6, x7, x8 and x9 'Learn Its' before commencing this step.

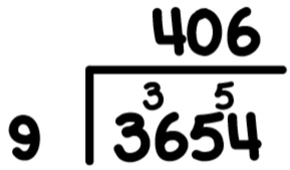
This step links to 'Basic Skills: Division: Step 22'.

Step 4



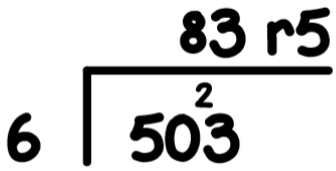
This is a small nudge of progression from Step 3 as we move into using our tables knowledge to divide a 3d number by any 1d number (still with no remainder in the answer).

Step 5



This is a further small nudge of progression from Step 4 as we now move into using our tables knowledge to divide a 4d number by any 1d number (still with no remainder in the answer).

Step 6



This step is where we confirm that children can find remainders in their answers too.

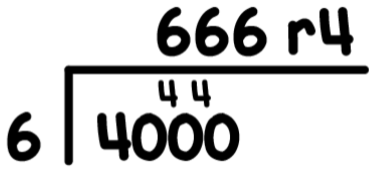
It is by no means a new concept as previously in CLIC we had pupils finding remainders as they divided with objects ('Basic Skills: Division: Step 15').

And more recently pupils have also been finding remainders as they move along the columns, it's just that now they don't move the remainder into the next column, they just record it as a remainder in the answer.

This is a significant milestone though since children can now solve any 2d (and then 3d) divided by 1d question.

Again, if appropriate, this could also be extended to ask children to think about contexts where the remainder is meaningful (see Step 7 here) if they are ready to grasp such a concept easily.

Step 7



Initially this step takes a small nudge of progression from children solving any 3d divided by 1d question to solving any 4d divided by 1d question.

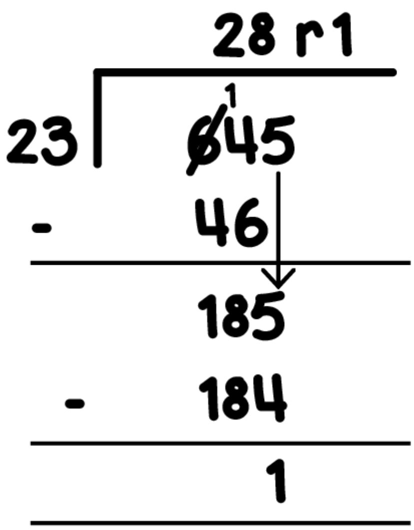
However, this is also the point where we don't move on until we know the learner has firmly grasped the concept of 'meaningful remainders'.

Meaningful remainders are where there is a real life context to the division scenario and the remainder can't be discounted since it has a significance. For example, we might have 29 people sleeping in 6 birth tents and whilst the division answer is 4 (i.e. 4 tents) the other 5 people still need a tent, and so 6 tents would be needed altogether.

Even if the context means the remainder is not significant (e.g. If there were 16 sweets being shared between 5 people) then the child still needs to have grasped the concept of meaningful remainders in order to know this.

The 'meaningful remainders' concept is not suddenly sprung on children at this step, indeed it can be modelled, with probing questions, all the way through the journey, including right back when children first came across remainders with objects ('[Basic Skills: Division: Step 15]') and even before that as they learn through play in the very early years, for example by placing 13 eggs into half dozen egg boxes shows that an extra box is needed, albeit just for one egg.

Step 8



This is the first time pupils divide by a 2d number. The new challenge this presents is that we can no longer use the 1d x 1d 'Learn Its' to solve division. However we do have other prior learning to lean on for success.

If pupils have been through the CLIC journey successfully then they will have gained the understanding necessary to underpin the column method from Step 5 of the 'Finding Multiples' Progress Drive from It's Nothing New.

Similarly, the pupil will also be able to quickly write out the first 10 multiples of the 2d number from the skills they developed in 'Coin Multiplication', and can also add multiples together to quickly find any multiple of the 2d number. This is extremely useful here since the pupil can then quickly answer the division challenge as they move along the columns (one could easily develop Coin Multiplication to the point where the child sees for themselves that they could continue to just find the highest multiple of the number without going past the target number in the question, and not need to keep doing it in 'bits' as they move along the columns – this is a natural extension of the thinking behind 'Finding Multiples').

x23	
1	23
2	46
3	69
4	92
5	115
6	138
7	161
8	184
9	207
10	230

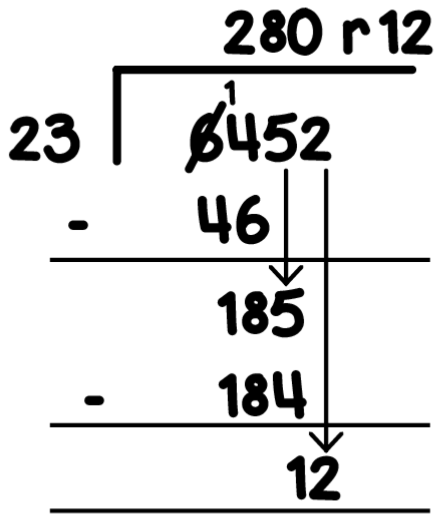
Just to be clear then, as soon as the learner sees the 2d number in the question they quickly write out their full coin card ready to use.

One further challenge is that sometimes the remainder for each individual column's division question is less easy to spot mentally compared to when we were dividing by 1d numbers. So, typically, the highest multiple of the 2d number is written under the digits in the question so that a simple column subtraction can be applied to find the remainder. At this point, instead of writing the remainder (i.e. the difference between the highest multiple of the 2d number and the number it is being divided into) as a mini-tens digit for the next column in the question, the digit from the next column in the question is brought down to place on the end of the remainder, and this is used to divide the 2d number into.

This process can then continue until we have found the whole number answer to the overall question.

An important progressive step is to then move on to provide questions where there is a remainder. This can just be presented as a remaining figure at this point, but it is useful to continue with the discussion of assessing the context of the remainder (when the question is set in a real life context).

Step 9



This step has 2 mini-steps of progression:

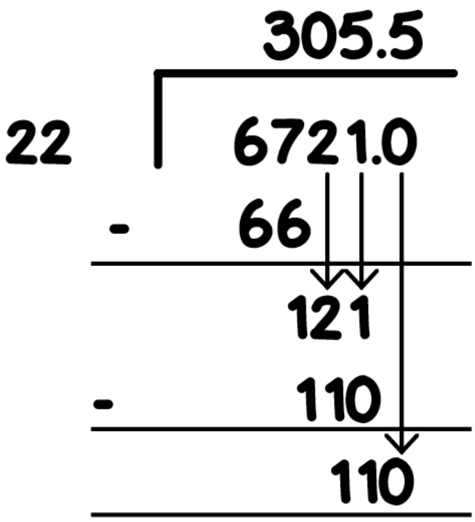
- Firstly to extend the skills of 3d divided by 2d into 4d divided by 2d (which requires no new skills just slightly greater numerical reward).
- Secondly to then take the remainder figure and represent it as a fraction. This is as easy as placing the remainder as a numerator with the 2d number from the division question as a denominator. In the example shown here the remainder would be:

$$\frac{12}{23}$$

- Choosing carefully constructed questions initially will allow for learners to access the understanding of why this shows the remainder as a fraction (for example, with 294 divided by 28 we find the answer is ‘10 remainder 14’, looking at the 14 as a numerator over 28 as a denominator allows learners to see that it must be a half, i.e. we actually found that there are 10 and a half 28s in 294). It is also useful to choose questions where learners can then easily reduce the fraction into its simplest terms.

x23	
1	23
2	46
3	69
4	92
5	115
6	138
7	161
8	184
9	207
10	230

Step 10



This last step sees the pupil now being asked to show the reminder as a decimal. In practice it is not as challenging as it may sound. After all, the children are used to the mechanics by now of whizzing along the columns, the only new skill is to take the final remainder and place it (as a mini-tens digit) in the tenths column of the question which is set up quickly by inserting a decimal point after the units column and then placing a zero in the tenths column.

It may be useful to retreat to division questions from earlier steps (e.g. dividing by 1d numbers) whilst this new skill is mastered and then returning to questions such as 4d divided by 2d after that.

Pupils ability should also be extended to questions that require 2 decimal places in the answer.

x22	
1	22
2	44
3	66
4	88
5	110
6	132
7	154
8	176
9	198
10	220