Understanding Your Child's Mathematics

Division Strategies

Partial Quotients with Large Numbers & Decimals

Project for Elementary Mathematics
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Let's now look at how partial quotients works when dividing larger numbers. Remember, watch your language; place value matters. Remember, you don't need to be exact at each step. You can be reasonably close and then narrow the precision as you proceed. The stronger your child's number sense is and his or her ability to "scale up" the fewer steps it will take. Having your child ask him or herself if the first estimate is close, or can they double or triple that estimate to get even closer, are the types of reflective questions that increases the precision over time.

Below is the same problem done at different levels of precision. Look at the types of questions asked that potentially increases the level of efficiency.

28)3,254	100
-2,800	
454	15
- 420	
34	+ 1
- 28	116 R 6
6	

The Script:

- *28 hundreds is two thousand eight hundred*
- *With 454 left, 10 twenty-eights is 280. Double that (560) is too large but half as much would be 140 + 280 so 15 twenty-eights 420*
- *With 34 left, that's one more 28, leaving 6 remaining so the total is 116 whole groups of 28 with 6 leftover*

Notice the use of 100 as a landmark. Notice how the language what 28 hundreds are leads directly to the answer one is looking for. Notice the scaling up around 10 groups of 28, doubling would be too big so half as much (5) is found to combine to make 15 groups of 28. That ability to scale up is the skill that you are looking to nurture over time with your child.

A more emergent version of this might still be able to start with 100 but an even more emergent strategy might only be able to double what 10 groups of 28 are. Let's look at such an emergent attempt.

28)3,254	20
- 560	
2,694	20
- 560	
2,134	20
.	
.	
.	

Notice the steps followed are the same but with a weaker number sense it merely takes longer. With more steps, there is an increase in the possibility to make an arithmetical error. In a problem like this, it is opportune to actually interrupt the child at, say, the third repetition and ask them, "Are you close or still really far away? Could you double or triple the 20 and save yourself some time?"

That kind of prompt nurtures the scaling up thinking necessary to become more and more efficient in the steps taken to become proficient with this strategy. They can grow into the strategy.

Partial Quotients Strategy with Decimals

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Division with decimals is typically a topic at fifth grade. The first place students need to grapple with this idea is in solving the problem to the tenths or hundredths place. Let's return to the problem 254 ÷ 8 and see how this works.

Language will be key here. It will be essential to talk in terms of tenths and hundredths to truly follow the place value, not in terms of "point 23" for .23. That number is "23 hundredths." Language matters in the development of place value.

Let's assume that the assignment is to divide through to the hundredths place. If that is the case, plan ahead and place the zeros into position in order to leave enough room.

8)254.00	30
- 240.	
14.	1
- 8.	
6.0	.7
- 5.6	
.40	+ .05
- .40	31.75
0	

The Script:

- *10 8s would be 80 so 30 8s is 240 so that's closer*
- *254 minus 240 is 14*
- *One 8 is 8 which is the closest I can get*
- *14 minus 8 is 6, and no more whole groups of 8 are possible*
- *6 is the same as "60 tenths." I can get "56 tenths" out of 60 tenths, leaving 4 tenths leftover*
- *4 tenths is the same as 40 hundredths. 5 hundredths times 8 is 40 hundredths. I have no more left so my answer is 31 and 75 hundredths.*

Notice the need to flexibly think of 6 as 60 tenths. This is where your son's or daughter's understanding of how decimals and fractions are linked is important. When we do the American Standard Algorithm in Division we actually ignore the decimal point, bring a 0 down, and say, "How many 8s are in 60?" ***The shift is in emphasizing the mathematical idea of re-representing any number into an equivalent form. This is a core place value concept!***

Re-representing Numbers

When I ask you precisely how many 10s are in the number 254, the answer is *25.4 tens.* Precisely how many hundreds are in 3,254, the answer is 32.54 hundreds. The same number in terms of 10s is 325.4 tens. Thinking flexibly in this manner is a sign of deep place value understanding. We often do these conversions without going the extra step of labeling our answer. Consider the following example:

3.5 million   Written as ones we would rewrite this as: 3,500,000 ones

How would you rewrite that same number as thousands?   3,500 thousands

The same skill is necessary when working with decimals. It is a question of *equivalent representations to make the numbers easier to work with!* $6 = \frac{60}{10} = \frac{600}{100}$ Remember back to our initial rules at the beginning of this series? Language matters in developing place value. If you don't like the numbers, change them, or in the case of decimals, re-represent them to make the numbers easier to work with. Always keep the mathematics visible.

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