Pennington C of E Primary School

Maths Calculation Policy

Introduction

This document provides examples of progression through the various calculation methods to support problem solving using the four operations (addition, subtraction, multiplication and division). It is based on the Calculation methods detailed within the Big Maths – CLIC file, a tool which the school has adopted in the teaching of the areas of number and calculation in Mathematics. As such, the Big Maths – CLIC file folder provides additional detail to support in the learning and teaching of the methods detailed in this document.

Purpose of the document

The purpose of the policy is to ensure consistent practice throughout the school thereby improving the understanding and attainment of pupils, in line with the development of mental and written calculations in addition, subtraction, multiplication and division. Written methods should always follow and support understanding. They are not age-related but progressive. It is important that pupils' calculation methods develop through each stage and do not move on to the next one until they are ready.

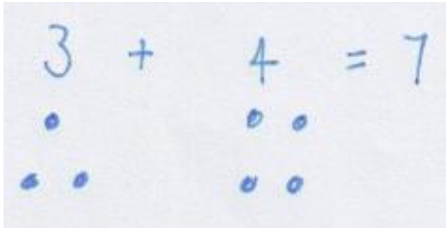
How the document is organised

The remainder of the document is organised into four separate sections, one for each of the four operations. Each operation progresses from high level understanding methods to short column methods. Column methods run alongside the high understanding methods and both should be taught as part of the children's mathematical journey. More detail for each step can be found in the CLIC fold

Addition - High Understanding Methods

Stage 1:

Step1: Using physical objects to count and add on.

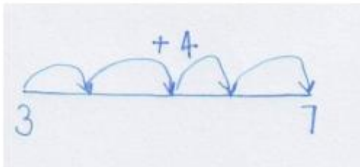


Steps 2-5: Finding totals using objects.

Steps 6-8: Reading and understanding number sentences and solving using objects.

Stage 2:

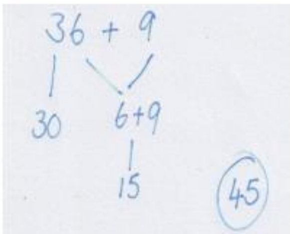
Steps 9-12: Use of prepared number lines to 20.Using an empty number line to record counting on (less formal presentation, used as jottings).



Steps 13-19:
Use of 100 squares to add on in 1's, 10's and a combination of these.

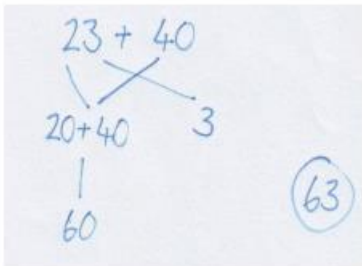
1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Step 20: Use of 'partitioning' to add 2d + 1d.

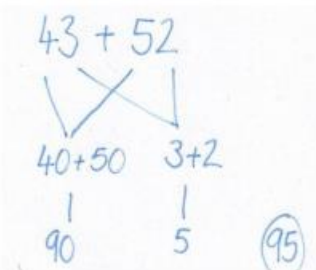


Stage 3:

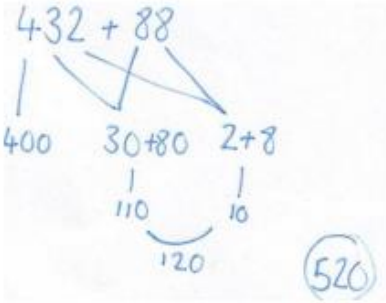
Step 22: Use of partitioning to add 2d + 2d, starting with multiples of 10.



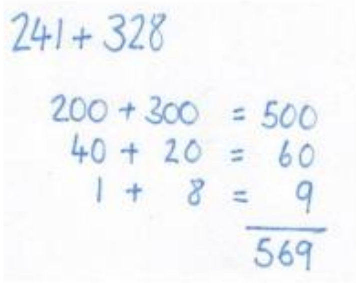
Step 24: Use of partitioning to add any 2d + 2d.



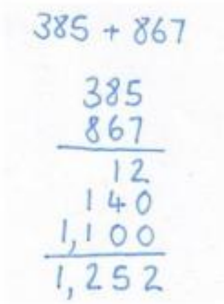
Step 27: Use of partitioning to add 3d + 2d.



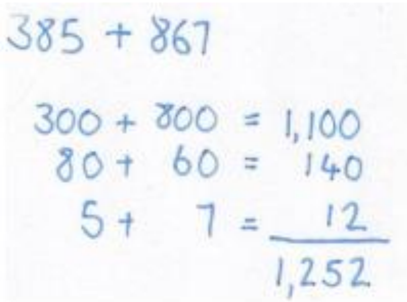
Step 28: Use of more formal layouts to add 3d + 3d.



Step 29: Use of more formal layouts to add 3d + 3d.

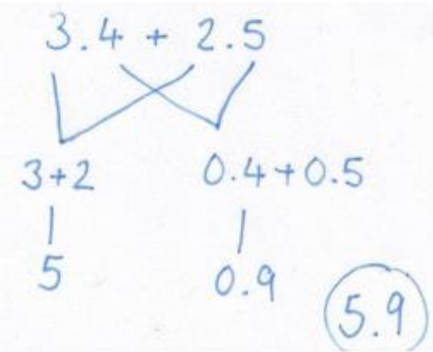


Step 29: Use of more formal layouts to add 3d + 3d, including where bridging is also required



Step 30: Adding decimals to 2dp, in the form of money (£2.34 + £3.45).

Stage 4:



Steps 34-37: Addition of decimals; U. 10th + U. 10th using partitioning. Moving onto U.10th 100th + U.10th 100th

Addition of decimals; U. 10th + U. 10th using more formal layo

U.10th 100th + U.10th 100th

Step 38: Extending to include 4d and various combinations of Th, H, T, U

Step 39: Addition of several numbers.

Step 40: Adding numbers with varied digits before and after the decimal place without requiring bridging. **13.4 + 2.53**

Stage 5:

Step 41: Adding numbers with mixed digits before and after the decimal place including those that require bridging. **8.67 + 19.8**

Addition - Column Methods

Step	I can...	Example
10	I can solve *any* 5d + 5d	81686 + 66549
9	I can use Column Addition for several numbers	868 582 + 654
8	I can solve *any* 4d + 4d	8686 + 6549
7	I can solve *any* 4d + 2d or 3d	6549 + 686
6	I can solve *any* 3d + 3d	686 + 549
5	I can solve a 3d + 3d	636 + 242
4	I can solve *any* 3d + 2d	547 + 94
3	I can solve a 3d + 2d	442 + 36
2	I can solve *any* 2d + 2d	76 + 48
1	I can solve a 2d + 2d	36 + 42

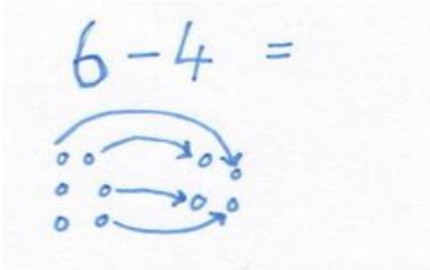
Step	I can...	Example
14	I can add numbers with mixed amounts of decimal places	8.689 + 6.54
13	I can add numbers with 3dp	8.686 + 6.549
12	I can add numbers with 2dp	8.68 + 6.54
11	I can add numbers with 1dp	18.7 + 56.4

<u>**Subtraction - High Understanding Methods**</u>

Stage 1 and 2 focuses on the notion of counting back, whereas from Stage 3 to 5 the emphasis switches to counting on and 'finding the gap'. At Stage 3, children should understand why this is possible (subtraction being the opposite of addition).

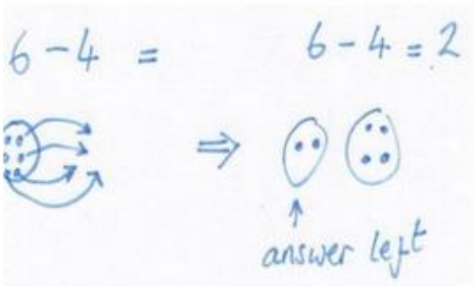
Stage 1:

Steps 1-6: Taking some objects away from a group. Progressing to counting how many are left (all with the use of physical objects).

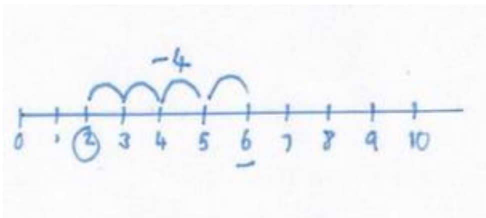


Stage 2:

Steps 7-8: Arranging (then solving) a number sentence, physically setting out the objects.



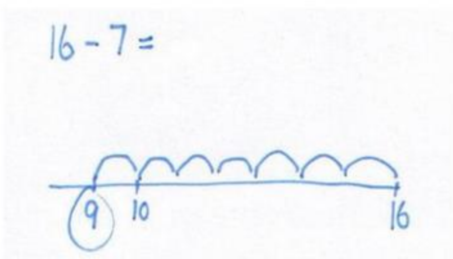
Step 9: Counting back on a structured number line.



Steps 10-11: Using a structured number line or 100 square to subtract a one digit number from 20. **20 – 4 = 16**

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Step 12: Using the empty number line, with jottings if required.



Step 13: Use of a 100 square to find a multiple of 10 and

subtract 10. 70 – 10 = 60

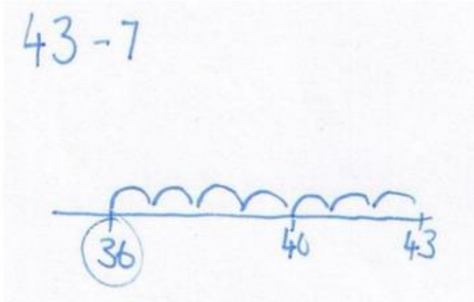
Step 14: Use of a 100 square to find any two-digit number and subtract 10. 83 – 10 = 73

Step 15: Use of a 100 square to find a multiple of 10 and subtract a multiple of 10. 80 – 20 = 60

Step 16: Use of a 100 square to find any two-digit number and subtract a multiple of 10. 83 – 20 = 63

Step 17: Use an empty number line to subtract 2d – 1d, not bridging tens.

Step 18: Use an empty number line to subtract 2d – 1d, including bridging.



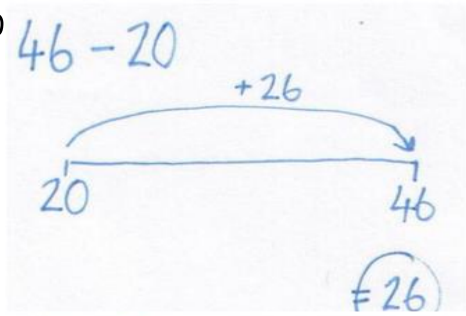
Stage 3:

With the focus moving to counting on, each progression follows the pattern:

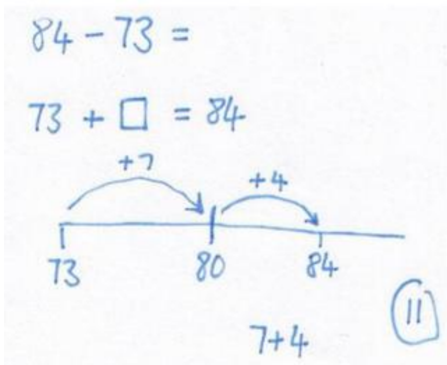
- Record numbers at either end of the empty number line (counting on left to right)
- Making two jumps (multiple of 10 where counting onto < 100, multiple of 100 where counting onto < 1,000)

Step 22: Finding the difference to the next multiple of 10

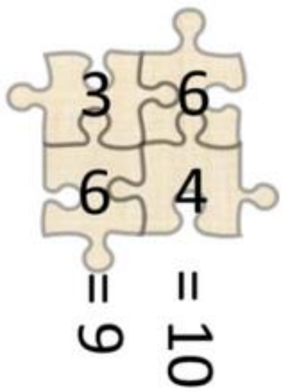
Step 24: Jumping from a multiple of 10.



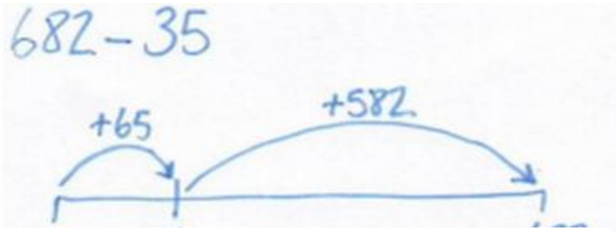
Step 25: Two jumps to solve 2d – 2d.



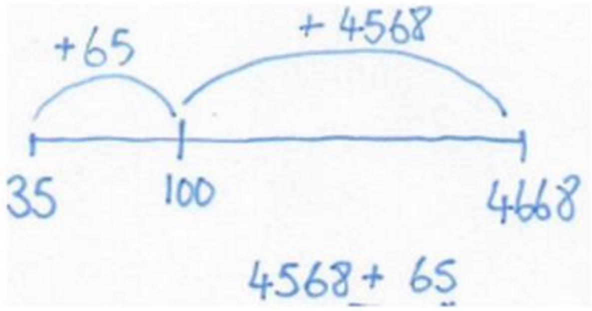
Step 28: Using 'jigsaw numbers'



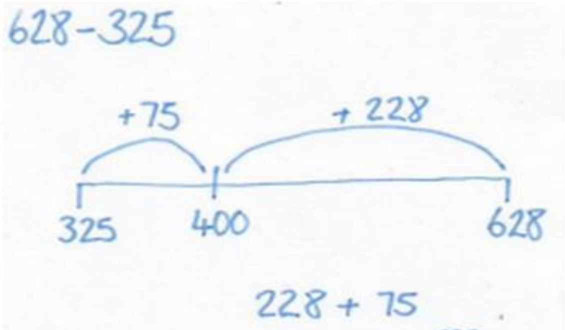
Step 30: Solving 3d – 2d.



Step 31: Solving 4d – 2d.

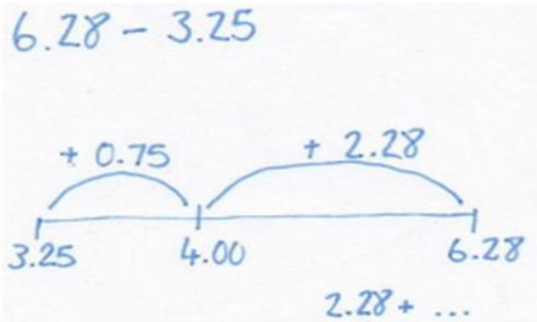


Step 32: Solving 3d – 3d.

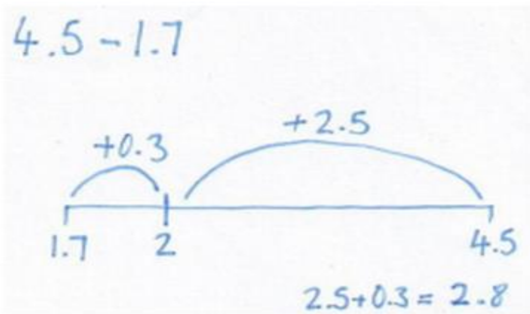


Stage 4:

Steps 33-34: Using money to solve subtractions involving U.10th 100^{th}



Step 35: Progressing to subtractions involving U.10th and U.10th 100^{th}



Step 36: Any whole number subtraction

Stage 5:

Step 37: Subtraction of numbers with mixed digits before and after the decimal place

Subtraction - Column Methods

Step	I can...	Example
12	I can subtract numbers with mixed amounts of dp	8.625 - 4.8
11	I can subtract numbers with 3dp	8.625 - 4.908
10	I can subtract numbers with 2dp	8.67 - 4.91

Step	I can...	Example
9	I can subtract numbers with 1dp	8.6 - 4.9
8	I can solve *any* 5d - 5d	95686 - 54749
7	I can solve *any* 4d - 4d	5686 - 4749
6	I can solve *any* 4d - 2d or 3d	5686 - 749
5	I can solve *any* 3d - 3d	985 - 596
4	I can solve *any* 3d - 2d	931 - 82
3	I can solve a 3d - 2d	986 - 42
2	I can solve *any* 2d - 2d	76 - 48
1	I can solve a 2d - 2d	96 - 42

Multiplication - High Understanding Methods

Stage 1:

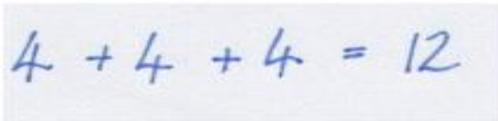
Steps 1-2: Use of physical objects to find totals. For example three lots of four cars.

Steps 3-4: Transferring to more abstract objects. For example, blocks / counters in groups.

Stage 2:

Steps 5-6: Drawing groups of dots. For example three lots of four dots.

Step 7: Repeated addition.

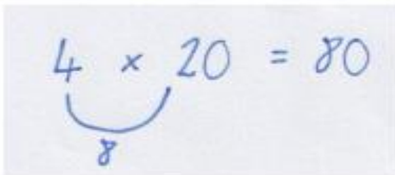


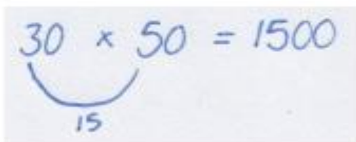
Step 8: Reading 3 x 4 as 3 'lots of' 4.

Stage 3:

Step 9: Using 2, 3, 4, 5 times table 'learn-its' to multiply 1d x 1d, as children should have improving instant recall of these facts by this stage.

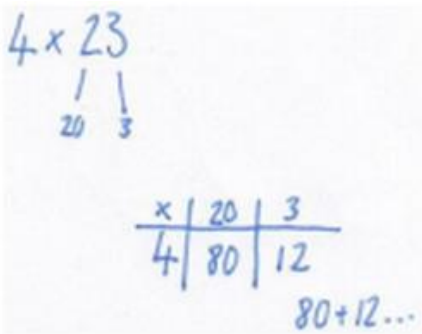
Step 10: Introduction of 'smile multiplications'. Using 1d x 1d 'learn its' combined with understanding of place value.





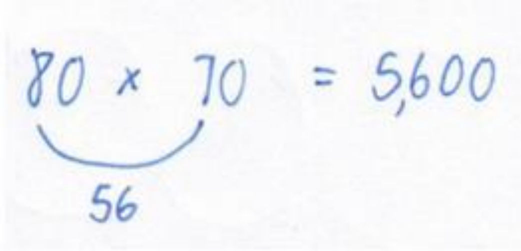
Step 11: Using 6, 7, 8, 9 times table 'learn-its' to multiply any grow instant recall of these facts by this stage.

Step 12: Introduction of the 'grid method' to solve 2d x 1d (where the 1d is in 2, 3, 4, 5 times table).



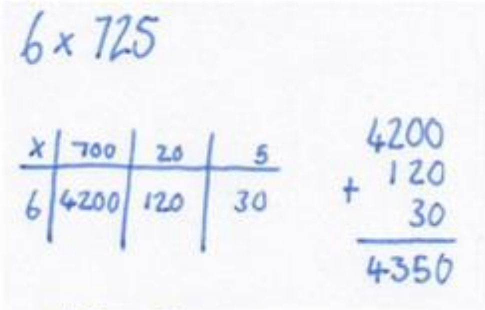
Stage 4:

Step 13: Use knowledge of 6, 7, 8, 9 times table 'learn-its' to solve any smile multiplication.

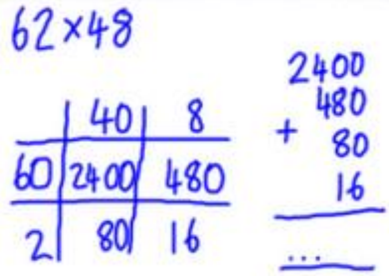


Step 14: Use of the grid method to solve any 2d x 1d.

Step 15: Use of the grid method to solve any 3d x 1d.



Step 16: Use of the grid method to solve any 2d x 2d.

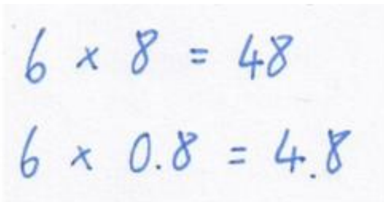


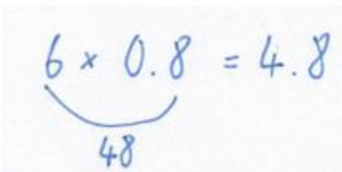
Refer to addition section for summing totals

Step 17: Solving 1d x U.10th, using known facts and place value.

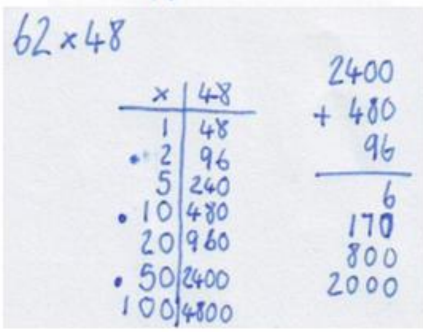
1. Recall tables fact

2. Make answer 10x smaller





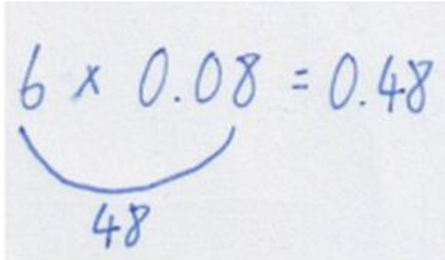
Step 18: Introduction of 'coin grids' and the 'coin method' to solve 2d x 2d.



Refer to addition section for summing totals

Stage 5:

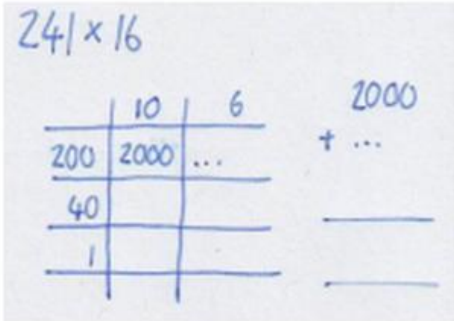
Step 19: Solving 1d x U.10th 100th



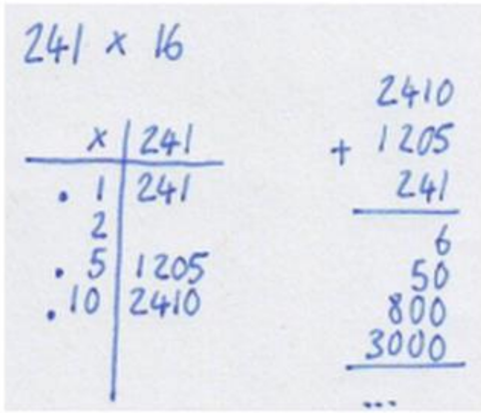
1. Recall tables fact

2. Make answer 100x smaller

Step 20: Use of the grid method to solve any 3d x 2d.



- Extension of coin grids and the coin method to solve 3 x 2d.
- Refining coin grids, so only those values required to solve the problem are found.



Refer to addition section for summing totals

Multiplication - Column Methods

Step	I can...	Example
11	I can solve *any* 1d.2dp x 2d	5.24 x 26
10	I can solve *any* 1d.1dp x 2d	5.2 x 36
9	I can solve *any* 1d.2dp x 1d	5.24 x 4
8	I can solve *any* 1d.1dp x 1d	5.6 x 4
7	I can solve *any* 4d x 2d	3123 x 22
6	I can solve *any* 4d x 1d	8152 x 6
5	I can solve *any* 3d x 2d	485 x 16
4	I can solve *any* 2d x 2d	85 x 16
3	I can solve *any* 3d x 1d	385 x 6
2	I can solve *any* 2d x 1d	85 x 6
1	I can solve a 2d x 1d	35 x 5

Division - High Understanding Methods

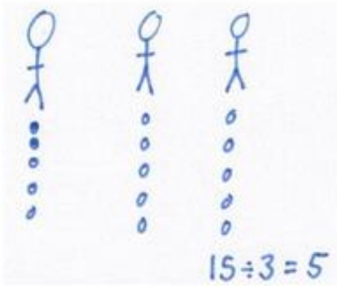
Stage 1:

Steps 1-2: Sharing out objects equally / fairly. Asking, "How many will each person have?"

Steps 3-4: Sharing between two. Halving even numbers of objects.

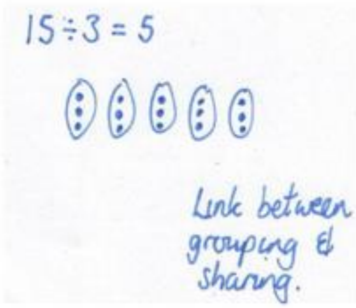
Stage 2:

Step 5: Sharing 6, 9, 12, 15 objects between 3.



Step 6: Sharing 6, 9, 12, 15 objects into 3.

- Introducing the ÷ symbol.



Steps 7-8: Sharing 8, 12, 16, 20 between and into 4.

Step 9: Solving ÷2, ÷3, ÷4 division problems. e.g.

e.g.

10 ÷ 2 = , 6 ÷ 3 =, 12 ÷ 4 =

Steps 10-12: Making groups of 2, 5 or 10 and counting.

Step 14: Physically solving a number sentence using objects and counting.

e.g.

15 ÷ 3 is 15 counters in 5 groups of 3

Step 15: Moving onto remainders.

e.g.

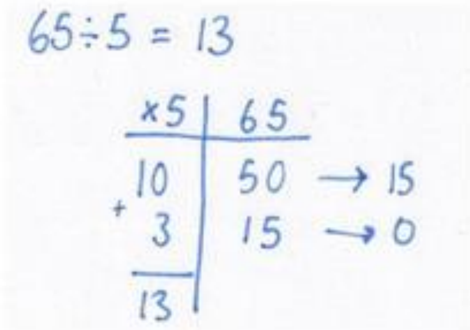
17 ÷ 3 is 17 counters in 5 groups of 3 with 2 left over

Stage 3:
Solving problems involving 2d ÷ 1d.

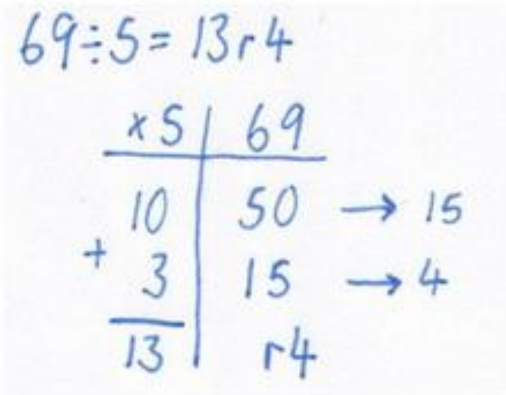
Step 16: Use of multiplication 'learn its' for 2, 3, 4, 5 and 10 times tables to find division facts through 'fact families'.

Step 17: Extending use of multiplication 'learn its' for 2, 3, 4, 5 and 10 times tables to find division facts and remainders.

Step 18: Combining two or more 2, 3, 4, 5, 10 x 'learn its' to solve division problems using 'division grids'.

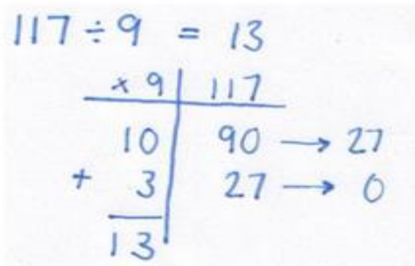


Step 19: Extending combining two or more 2, 3, 4, 5, 10 x 'learn its' to solve division problems involving remainders.

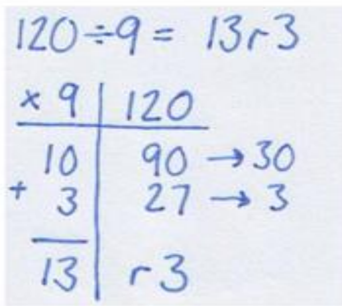


Stage 4:
Solving problems involving 2d ÷ 1d, and 3d ÷ 1d.

Step 22: Combining two or more 9, 7, 8, 9 x 'learn its' to solve division problems using 'division grids'.



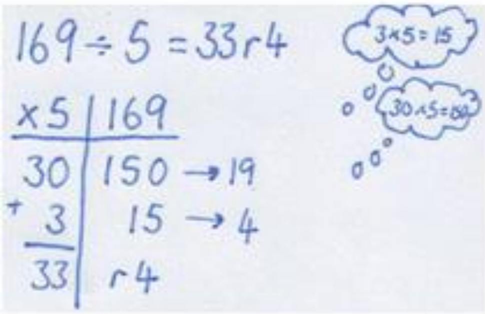
Step 23: Extending combining two or more 9, 7, 8, 9 x 'learn its' to solve division problems involving remainders.



Step 24: Combining knowledge of smile multiplications (and their fact families) to solve division problems with greater efficiency

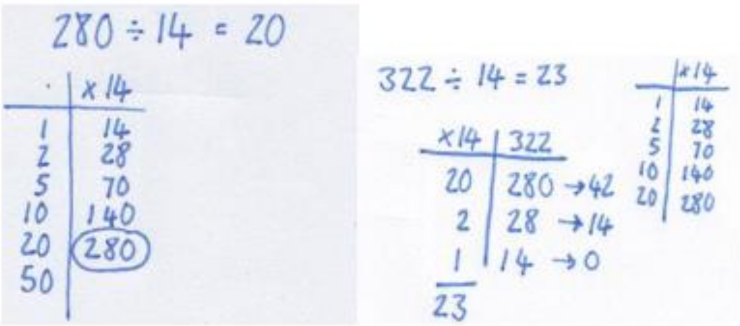
Step 25: Combining knowledge of smile multiplications (and their fact families) to solve division problems with greater efficiency, including those that give rise to remainders.

Step 27: Extending to solve 3d ÷ 1d, including those that give rise to remainders.

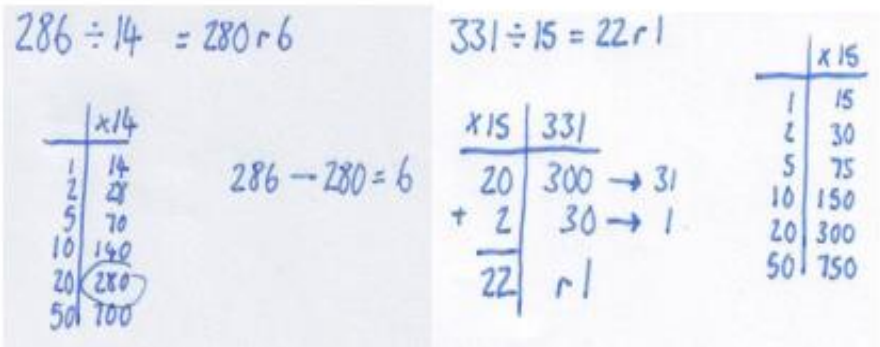


Stage 5:

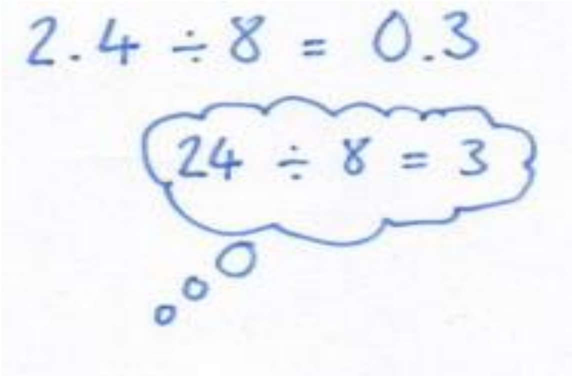
Step 28: Using coin grids to support 3d ÷ 2d. Combining two or more coin facts to solve division problems.



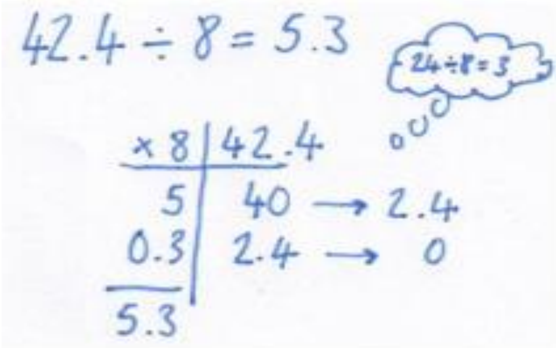
Step 29: Extending to those that give rise to remainders.



Step 32: Solving decimal division problems, using 'learn its' and understanding of place value.



Step 33:



Division - Column Method

Step	I can...	Example
10	I can solve division with decimal places in the answer	22 ⟌ 6721
9	I can solve any 4d ÷ 2d And show remainder as a fraction	23 ⟌ 6452
8	I can solve any 3d ÷ 2d	23 ⟌ 645
7	I can solve any 4d ÷ 1d And interpret context of remainder	6 ⟌ 4000
6	I can solve any 2d ÷ 1d (and 3d ÷ 1d) With remainders	6 ⟌ 503
5	I can solve a 4d ÷ 1d (using any table) No remainders in answer	9 ⟌ 3654
4	I can solve a 3d ÷ 1d (using any table) No remainders in answer	7 ⟌ 294
3	I can solve a 2d ÷ 1d (using any table) No remainders in answer	6 ⟌ 84
2	I can solve a 2d ÷ 1d (using x2,3,4,5) No remainders in answer	3 ⟌ 81
1	I can solve a 2d ÷ 1d (using x2,3,4,5) No remainders inside question	3 ⟌ 69

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