Hurst Green Primary School

Written Calculations Policy

Purpose of study

Mathematics is a creative and highly inter-connected discipline that has been developed over centuries, providing the solution to some of history's most intriguing problems. It is essential to everyday life, critical to science, technology and engineering, and necessary for financial literacy and most forms of employment. A high-quality mathematics education therefore provides a foundation for understanding the world, the ability to reason mathematically, an appreciation of the beauty and power of mathematics, and a sense of enjoyment and curiosity about the subject.

Aims

The national curriculum for mathematics aims to ensure that all pupils:

- become **fluent** in the fundamentals of mathematics, including through varied and frequent practice with increasingly complex problems over time, so that pupils develop conceptual understanding and the ability to recall and apply knowledge rapidly and accurately.
- **reason mathematically** by following a line of enquiry, conjecturing relationships and generalisations, and developing an argument, justification or proof using mathematical language
- can **solve problems** by applying their mathematics to a variety of routine and non- routine problems with increasing sophistication, including breaking down problems into a series of simpler steps and persevering in seeking solutions.

(National Curriculum, 2014 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/335158/PRIMARY_national_curriculum_-_Mathematics_220714.pdf **)**

The teaching of Mathematics within school aims to follow the three primary aims of the National Curriculum by delivering lessons which initially develop a strong sense of fluency of a particular topic before allowing children to apply those skills to reasoning and problem solving based tasks.

Without a strong understanding of Place Value and Number, a child cannot be expected to manipulate facts to explore more challenging concepts. Therefore, as a school, we place great emphasis upon these topics and continually revisit them throughout the child's learning journey at Hurst Green.

The fluent recall of Times Table facts is key to success within Maths. Throughout Years 2,3 and 4, children will be explicitly taught their times table facts for these particular tables whilst gradually being introduced to problems which these can be applied to. Throughout Years 5 and 6, Times Tables aren't explicitly taught (as per curriculum guidelines) but rather it is expected that children have a sufficient fluency with them so as to apply their knowledge to more demanding topics i.e. Fractions, Decimals and Percentages.

As such is the importance of Times Table recall and understanding, the Government have introduced the MTC (Multiplication Tables Check) - a statutory, online test, assessing children's recall of tables up to 12x12. The test is mandatory for all pupils in Year 4 beginning in 2020. Results from the test will not be published in league tables, but rather be used by teachers and senior leaders to implement support for the children who are not yet fluent with the times table facts that will ensure their mathematical success in Years 5 and 6.

Why do we need this policy?

- To ensure consistency in methods taught throughout the school.
- To develop progression from informal / practical methods of recording to written methods for each of the four operations.
- To provide an aid to help parents understanding of how the four operations are taught at Hurst Green.

Things to remember

- Children need to know number and multiplication facts by heart.
- Practical equipment should be used (where appropriate) when introducing or reviewing a concept.
- Make sure that all mathematical vocabulary for all topics is introduced and recapped throughout the year, e.g. subtraction is also known as take away, counting back and difference. This understanding will be especially useful for **reasoning** and **problem solving** based activities.
- Children who make persistent mistakes should return to the method that they can use accurately until ready to move on.
- When revising or extending to harder numbers, refer back to expanded methods. This helps reinforce understanding and reminds children that they have an alternative to fall back on if they are having difficulties.
- Children should be introduced to calculators from Foundation stage, developing skills to use them effectively in Years 4 to 6.
- Always decide first whether a mental method is appropriate/more efficient than a written method.
- Always check the answer, preferably using a different method e.g. the inverse operation.
- Children should be encouraged to estimate their answers before calculating them.

Stages in Addition

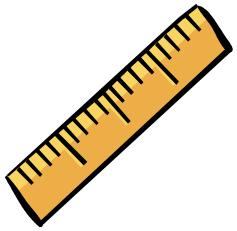
Informal counting methods - use objects and fingers:

1) Counting songs/rhymes

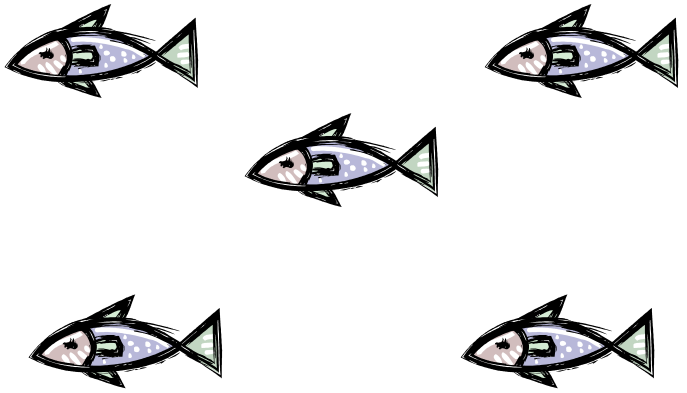
Combine groups of objects in a group.

Combine groups of objects in a line

Use of blank number lines

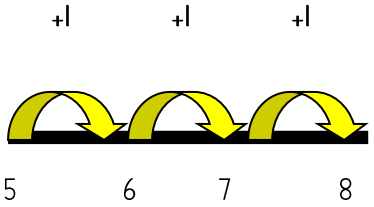


Pictorial addition

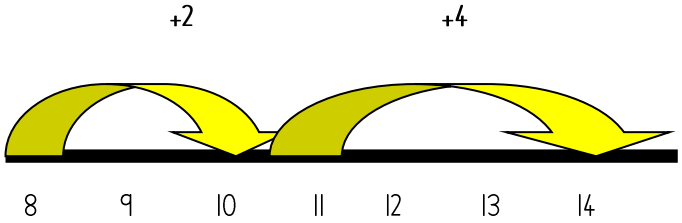


2) Introduce addition within 10 using a number line 3) Introduce addition within 20

5 + 3 = 8

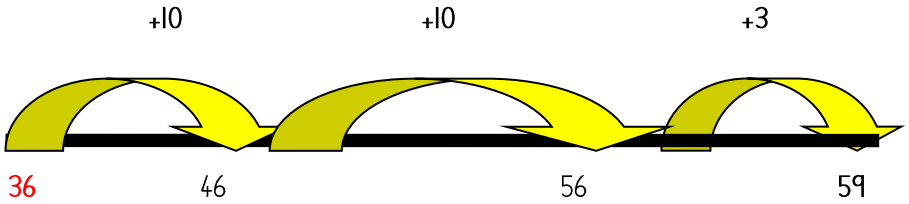


8 + 6 = 14



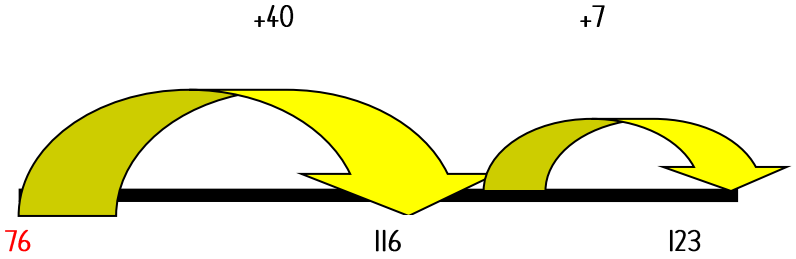
3) Children to then progress onto totalling two two-digit numbers using a number line,

36+23 =

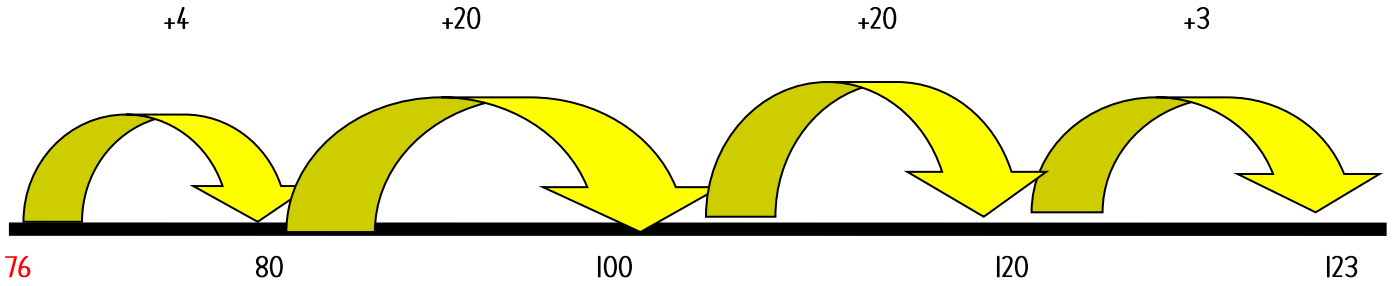


*Either do this in two jumps of ten, or one jump of twenty.

76 + 47 =



d) Counting on to the nearest multiple of ten/hundred using a number line.



These are examples of jumps that could be made. However, children should be allowed to choose jumps that they themselves feel comfortable with.

4) Introduce a number square to add numbers within 50.

37 + 8 = Find 37 on the number square and count on 8.

5) Use the number square to add two digit numbers within 100 by jumping on in tens and ones.

6) Partitioning (see mental calculations policy)

7) Column Method – children need to be told to add the ones first. Use visual aids to introduce carrying – bundles of straws, counters, Diennes blocks etc... Introduce expanded before moving onto the efficient column method.

40+7
+70+6
110 + 13

47
+ 76
123
11

(EFFICIENT METHOD)

Bigger numbers and decimals

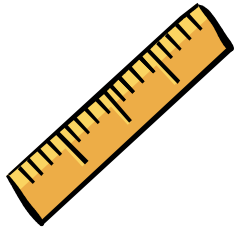
Extend to adding three two-digit numbers, two and three digit numbers as well as decimals. Remember to line the decimal points up under each other when adding mixed numbers.

Don't focus on the addition of 4 digit numbers, as children should be able to apply method once secure with subtracting 3 digit numbers.

Stages in Subtraction

Informal methods:

1) Counting songs/rhymes – use objects and fingers.
Use of blank number lines to count back a small number

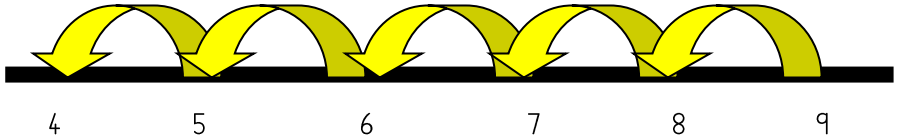


2) Introduce subtraction using pictures

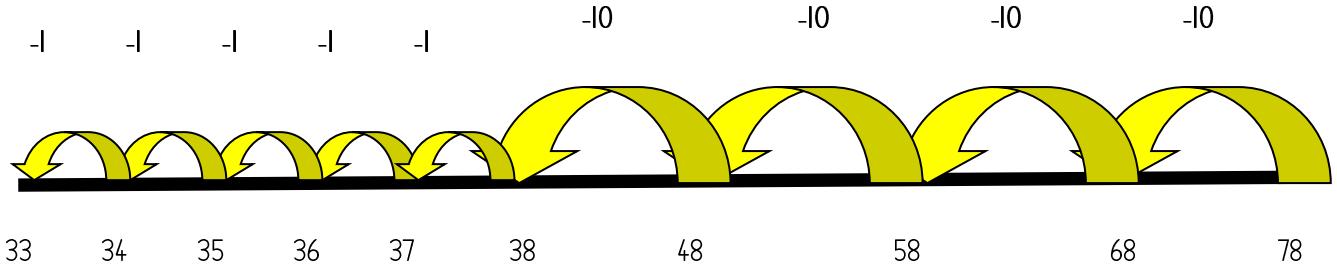
E.g. 9 – 5 = 4

3) Introduce subtraction using a number line by **counting back**.

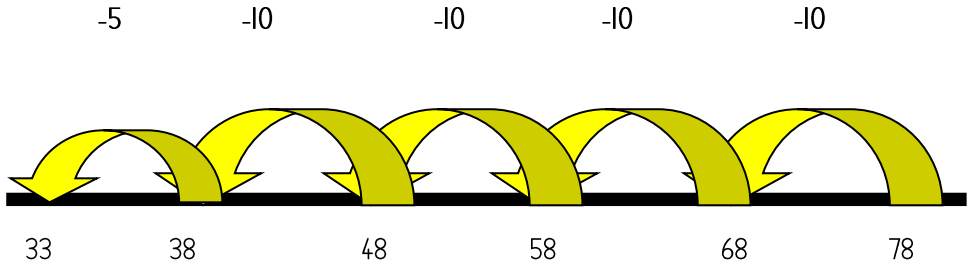
a) E.g. 9 - 5 = 4



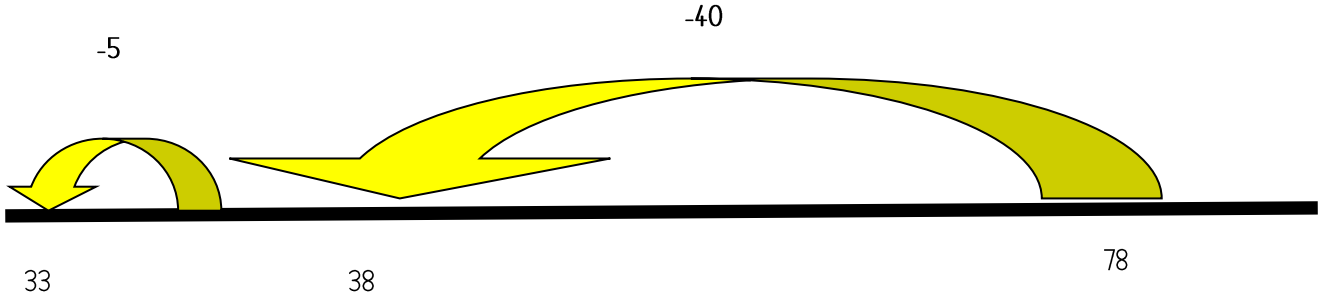
b) 78 – 45 = 33



c) 78 – 45 = 33

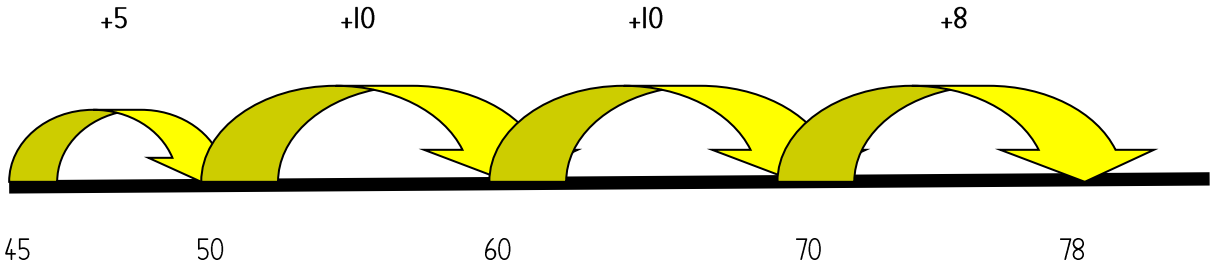


d) 78 – 45 = 33

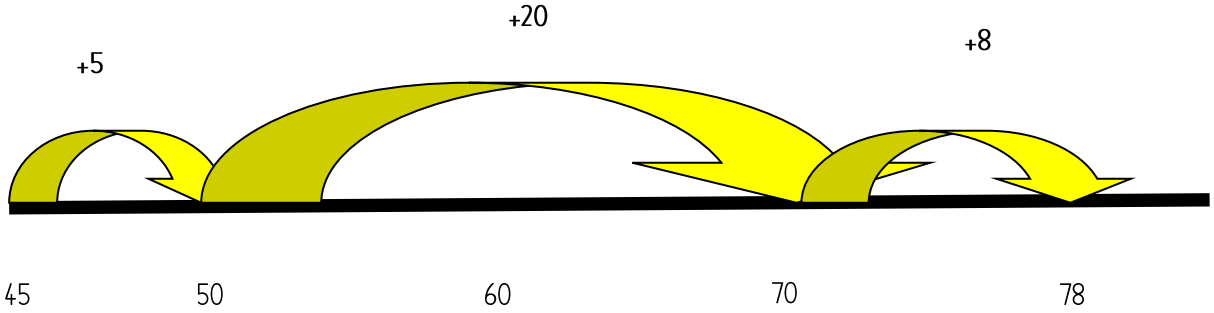


4) Using number lines introduce complementary addition – how **counting on** can be used for subtraction. Teach **counting on** as a method alongside **counting back**. Refer to as difference rather than take away.

a) 78 – 45 = 33



b) 78 – 45 = 33



5) Introduce subtraction using a number square.

a) Subtract numbers within 20.

17 - 8 = Find 17 on the number square and count back 8.

b) Subtract numbers within 50.

34 - 6 = Find 34 on the number square and count back 6.

c) Subtract numbers within 100.

57 - 23 = Find 57. Show children how to use the number square to count 2 tens and 3 ones on a number square to find the answer.

6) Partitioning (see mental calculations policy)

7) Column subtraction, contracting the working to a compact form. (EFFICIENT METHOD)

35	56	50+6 (40 16)	56 (4)
- 23	- 28	- 20+8	28
12 (fig.1)		20+8	28 (fig.2)

Apparatus MUST be used to introduce the method to ensure understanding e.g. straws (bundles of ten), Diennes blocks, counters, coins etc... THE EXPANDED METHOD MUST BE TAUGHT BEFORE THE COMPACT METHOD TO ENSURE UNDERSTANDING OF EXCHANGE.

Introduce simple subtractions (fig.1) with no exchange before moving on to exchange (fig 2). DO NOT refer to this as borrowing as you are not borrowing to give back i.e. exchanging a ten for ten ones.

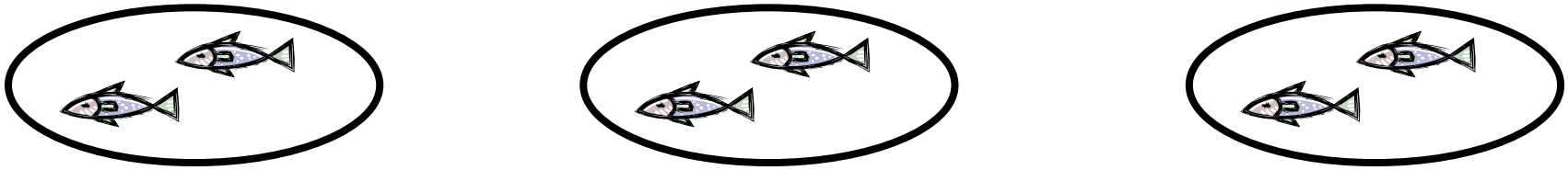
Bigger numbers and decimals

Extend to subtracting three two-digit numbers, two and three as well as decimals. Remember to line the decimal points up under each other when subtracting mixed numbers.

Don't focus on the subtraction of 4 digit numbers, as children should be able to apply method once secure with subtracting 3 digit numbers.

Stages in Multiplication

1a) Practical grouping of objects/pictures e.g. 3x2 = three groups of two



1b) Repeated Addition:

2 + 2 + 2 = 3 lots of 2 = 3 x 2

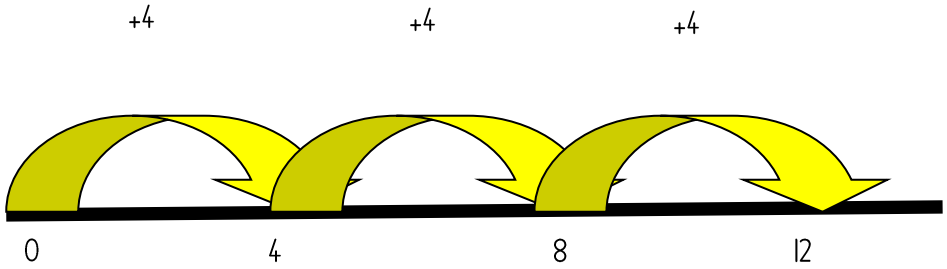
1c) Introduce arrays

$3 \times 2 = 6$

$2 \times 3 = 6$

2) Show repeated addition using a number line

3 x 4 = 12



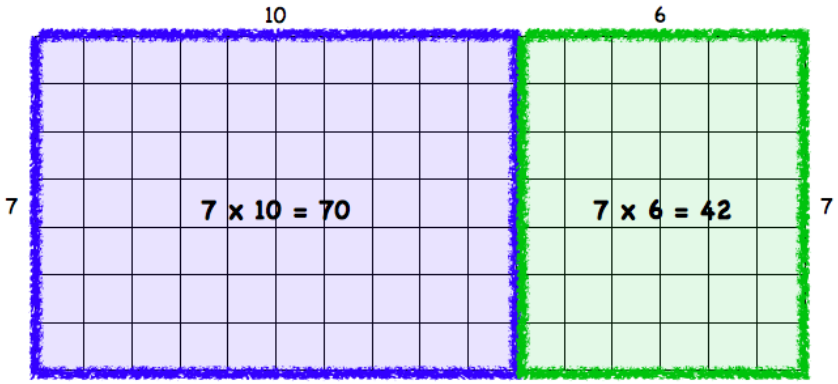
3) Mental method using partitioning (see mental calculations policy)

4) Grid Method – use to introduce a more formal written method for multiplication sums. *This is not considered an efficient method and may not gain method marks in Year 6 SATs.*

A great visual aid to help introduce OR SUPPORT the grid method.

7 x 16 =

7 x (10 + 6) =



70 + 42 = 112

Grid Layout

38 x 7=

X	30	8
7	210	56

210
+ 56
266

Extend to bigger numbers: 56 x 27

56 x 27 = (50 + 6) x (20 + 7)

X	50	6	
20	1000	120	1120
7	350	42	392
			1512

7) Vertical multiplication compact method (EFFICIENT METHOD)

```
  38          274
 X 7         x23
 266         822      (274 x 3)
  5         5480      (274 x 20)
            6302
```

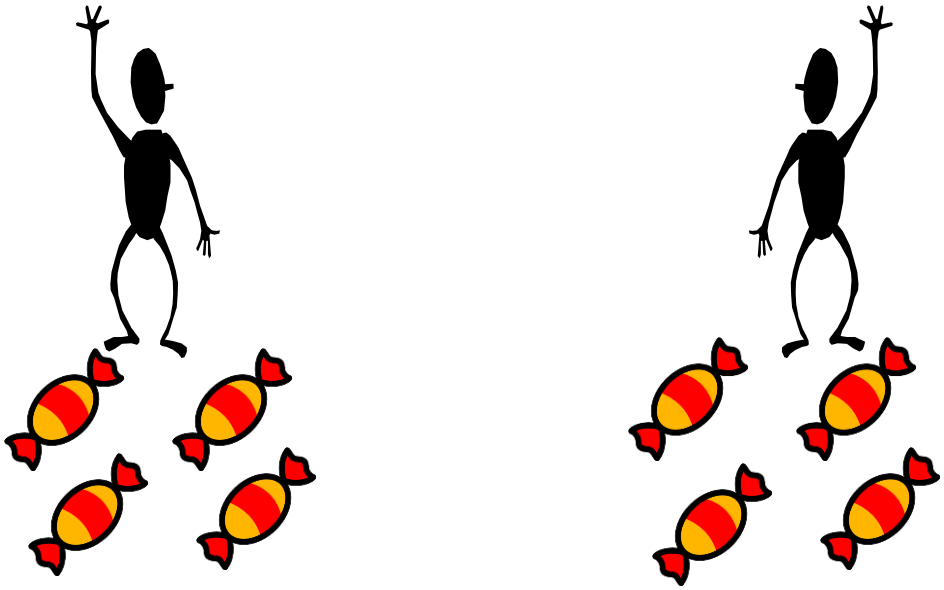
Begin with two digit numbers multiplied by one digit numbers. Gradually progress to larger sums e.g. two digits x three digits and three digits x three digits. Also apply the method to multiplying decimal numbers.

Stages in division

To introduce division it should be practical, using equipment to demonstrate.

Children are to understand division as sharing and grouping, which is repeated subtraction.

1) Introduce division as sharing (practical only). 8 sweets are shared equally between 2 people. How many sweets does each one get?

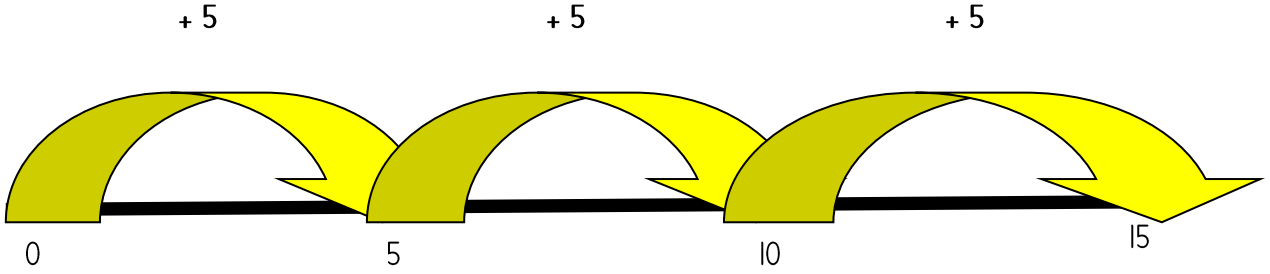


2) Division as grouping (practical and jottings).

Interpret 8 ÷ 2 as "how many 2's make 8"? Encourage children to count up rather than count back.

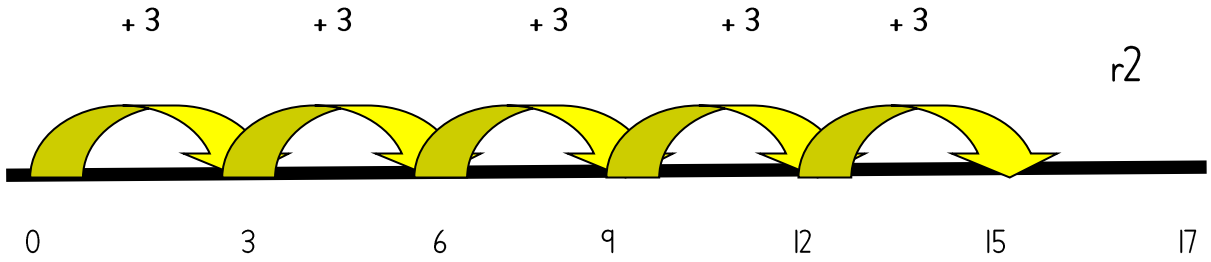
Progress on to use of number lines to count up rather than count back.

3) 15 ÷ 5 = 3



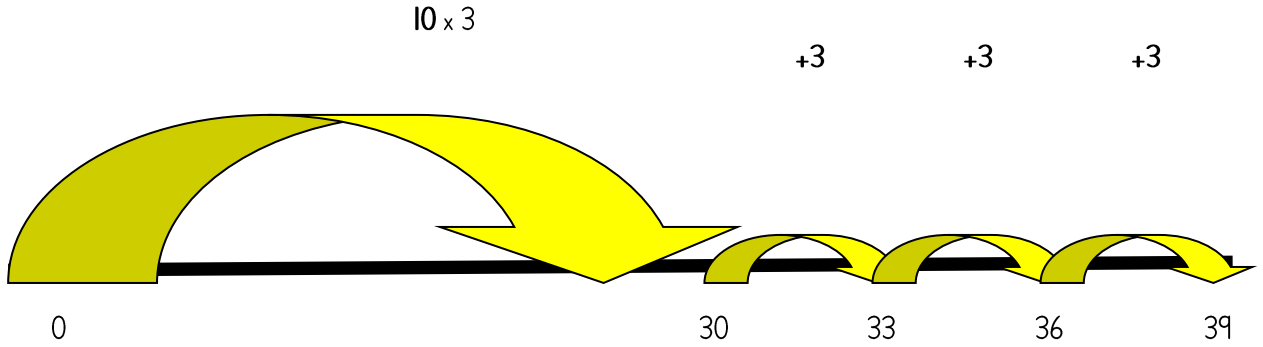
Move on to using number lines to calculate remainders.

5) 17 ÷ 3 = 5r2



Once confident with the number line, encourage the children to use known table facts to shorten their calculations, and become more efficient.

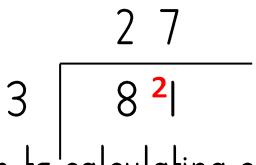
6) 39 ÷ 3 = 13



Once the children are secure with the number line, move on to using the bus stop method. (EFFICIENT METHOD)

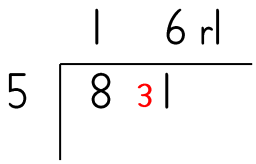
Begin with simple divisions which include no remainders. It is useful to support this with practical equipment to begin with.

7) 81 ÷ 3 = 27



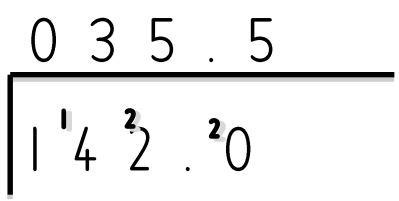
Move on to calculating sums, which include remainders.

7) 81 ÷ 5



9) Once the children are secure with this, progress onto calculating remainders as decimals.

142 ÷ 4 =



10) You can use practical equipment to introduce Long division, but this isn't necessary.

(EFFICIENT METHOD)

581 ÷ 23 =

```
      2 5 r6
   ___________
23 | 5 8 1
   - 4 6
   -------
     1 2 1
   - 1 1 5
   -------
         6
```

Answer = 25r6

x	23
1	23
2	46
3	59
4	
5	115
6	
7	
8	
9	
10	230

Children must use a jottings table. Encourage them to fill in information for x1, 2, 10 and 5. Then, fill out the rest only when necessary.
(In this example, only x3 needed to be added)